COST OF LIVING ADJUSTMENT FOR
MILITARY PERSONNEL

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THESIS

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FOR
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Cost of Living Adjustment

For

Military Personnel

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ABSTRACT

This study presents an analysis of the differences in the cost of living between civilian and military families. An index analogous to the Consumer Price Index (CPI) is constructed for military personnel. In constructing this new index we discuss both the theoretical and empirical basis for the existing Consumer Price Indices. We obtain this modified CPI for the military (MCPI) using two approaches. First we construct a new index considering only the effect on the CPI of those commodities available either free or at reduced prices to military personnel. Second we construct a military counterpart of the CPI considering only the unique geographic distribution of military personnel. Our results suggest that the MCPI has risen less rapidly than the CPI during the period 1961-1970.

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I. INTRODUCTION

The existence of differences in the cost of living between civilian and military families with similar money income is a fact known to almost everybody. The purpose of this thesis is to analyze these differences in detail and to construct, for cost of living adjustment purposes, an index analogous to the Consumer Price Index (CPI). We term this new index the Military Consumer Price Index (MCPI). This index should provide a foundation for developing an operational cost of living adjustment for active duty as well as retired military personnel.

In the first part of this study, composed of Chapters II and III, the theoretical base for the CPI is given. The methods employed to obtain the CPI in the U. S. are presented. In both chapters emphasis is given to those areas that we subsequently use to develop the MCPI.

In the second part, composed of Chapters IV and V, the rationale for for a military CPI is discussed in some detail. A modified CPI for the military is then actually constructed. Here we use two approaches. First we consider the influence on the CPI of commodities that military personnel can get free or with some discount. Second we consider the effect on the CPI of the unique geographic distribution of military personnel.

II. THE THEORY OF THE CONSUMER PRICE INDEX

This chapter serves as an introduction to the complicated problem of obtaining a Consumer Price Index (CPI). Specifically, in this chapter the economic basis of the CPI is analyzed. This is intended to provide perspective on our construction of a military consumer price index.

A. DEFINITION AND INTERPRETATION OF THE INDICES

Three indices will be introduced and interpreted in the following paragraphs. The first one is the Laspeyres index that is defined by the following relation:

$$L = \frac{\sum_i p_i^1 q_i^0}{\sum_i p_i^0 q_i^0} \tag{2-1}$$

where: p_i^1 = price of commodity i purchased in period 1

p_i^0 = price of commodity i purchased in period 0

q_i^0 = quantity of commodity i purchased in period 0

This index measures the relative change in the cost of the market basket[1] purchased in the base period at a subsequent period's prices. Note that in this formula the quantities purchased in the base period are held constant in both periods and the only change is in the price in the two periods. We call the second period the "given" period.

The second index to be considered is the Paasche index that is defined by:

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[1]The market basket is defined as all the goods and services an individual or family buys.

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$$P = \frac{\sum\limits_{i} p_i^1 q_i^1}{\sum\limits_{i} p_i^0 q_i^1} \qquad (2\text{-}2)$$

where

q_i^1 = quantity of commodity i purchased in period 1

This index measures the relative change in the cost of the market bas-
ket in the given period to the same basket at a previous period's prices.

Here the quantities are also held constant but in this case we use the

given year's quantities.

The third index measures the relative change of income and is defined

by:

$$E = \frac{\sum\limits_{i} p_i^1 q_i^1}{\sum\limits_{i} p_i^0 q_i^0} \qquad (2\text{-}3)$$

Here both the prices and quantities may be different in the two peri-
ods.[2]

B. ANALYSIS OF THE INDICES

Now let's discuss in some detail what these indices mean and how they

can be used for the purpose of this thesis. Here we are mainly concerned

about L and P. Relative Income "E" will be used only for comparison.

There exists three possible situations for each of the two indices L

and P. These are, L > 1, L = 1, L < 1, and P > 1, P = 1, P < 1. These

inequalities can be interpreted as market baskets costing more, equal or

less in the given period compared with the base period. The period of the

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[2]Note that it is assumed that the individual does not save part of
his income, i.e. income equals expenditure. See Appendix A for the case
when the individual saves part of his income.

market basket is the only difference between L and P. To obtain some important information we need to discuss the Laspeyres and Paasche index in more detail.

1. Laspeyres Index Analysis

In Figure 2-1 a partial indifference map is presented although indifference curves are not shown. The axes represent the two commodities X_1 and X_2. The line $q_1^0 \, q_2^0$ is the budget line for period zero. The point Q_0 is chosen to be the optimal point on that line, i.e. Q_0 is preferred to all other points that lie on or below the budget line.

In period one the prices have changed and the new budget line is $q_1^1 \, q_2^1$. In general, this line can pass through the point Q_0, to the left of (below) Q_0 or to the right of (above) Q_0. In the first case when the line passes through Q_0 it can be said that the optimal point to be chosen by the individual will be on at least as high an indifference curve as the point Q_0 because Q_0 is attainable and could be chosen. In this case he will not be worse off in period one compared with period zero and he may be better off in period one.

When the budget line passes to the right of (above) Q_0, the individual will be better off in period one compared with period zero because he can choose an optimal point Q_1 that is on a higher indifference curve than is Q_0. If the budget line passes to the left of (below) Q_0, nothing can be said about period one because Q_1 can be better than Q_0 in some cases and can be worse than Q_0 in other cases.

These 3 cases are very closely related to the 3 possible situations of the Laspeyres index. The case in which L = E corresponds to the case in which the new budget line passes through Q_0. L < E corresponds to the case where the new budget line passes to the right of Q_0 and L > E represents the case when the new budget line passes to the left of Q_0.

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FIG 2−1

PARTIAL INDIFFERENCE MAP FOR THE LASPEYRES INDEX
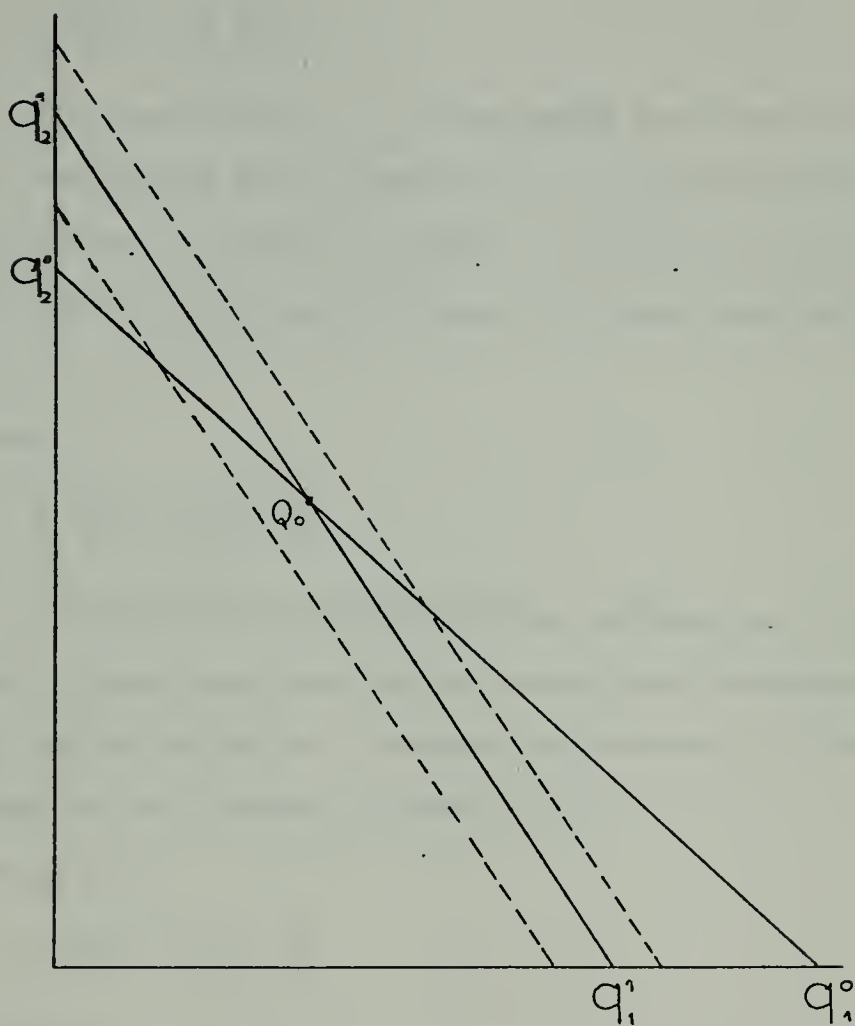
This is explained as follows:

When E = L we have

$$\frac{\sum\limits_{i} p_i^1 q_i^1}{\sum\limits_{i} p_i^0 q_i^0} = \frac{\sum\limits_{i} p_i^1 q_i^0}{\sum\limits_{i} p_i^0 q_i^0}$$

or

$$\sum\limits_{i} p_i^1 q_i^1 = \sum\limits_{i} p_i^1 q_i^0$$

This means that if E = L, the market basket purchased in period one at period one's prices costs the same as the market basket purchased in period zero at period one's prices. Therefore the individual will not be worse off in period one with respect to period zero and may be better off.

When E > L

$$\sum\limits_{i} p_i^1 q_i^1 > \sum\limits_{i} p_i^1 q_i^0$$

This means that the market basket purchased in period one at period one's prices costs more than the market basket purchased in period zero at period one prices. Therefore the individual will be better off in period one with respect to period zero.

When E < L

$$\sum\limits_{i} p_i^1 q_i^1 < \sum\limits_{i} p_i^1 q_i^0$$

That means that the market basket purchased in period zero is not available in period one. This condition does not automatically mean the individual was better off in period zero. In fact no inference can be drawn from this relationship between E and L.

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2. Paasche Index Analysis

In Figure 2-2, the point Q_1 is defined as the optimal point of the budget line $q_1^1 \, q_2^1$. Now, we want to figure out how much the given year market basket would have cost in the base year. Then, when the line $q_1^0 \, q_2^0$ passes through Q_1 the individual is not worse off in the base year with respect to the given year because Q_1 is attainable. If $q_1^0 \, q_2^0$ passes to the left of Q_1 (below Q_1) we can not say anything since the individual may be better off as worse off in period zero with respect to period one. On the other hand, if $q_1^0 \, q_2^0$ passes to the right of Q_1 (above Q_1) then the individual is better off in period zero with respect to period one.

These three cases are the three possible relationships of the Paasche index to the income index. The case that P equals to E means mathematically that

$$\frac{\sum_i p_i^1 q_i^1}{\sum_i p_i^0 q_i^0} = \frac{\sum_i p_i^1 q_i^1}{\sum_i p_i^0 q_i^1}$$

that is

$$\sum_i p_i^0 q_i^1 = \sum_i p_i^0 q_i^0$$

Which means the individual is not worse off in period zero with respect to period one.

If P < E this implies

$$\sum_i p_i^0 q_i^1 > \sum_i p_i^0 q_i^0$$

In this case, as shown in Figure 2-2, the line $q_1^0 \, q_2^0$ is to the left of the point Q_1. We can not make any conclusion from this situation.

And if P > E then

$$\sum_i p_i^0 q_i^1 < \sum_i p_i^0 q_i^0$$

FIG. 2-2

PARTIAL INDIFFERENCE MAP FOR
THE PAASCHE INDEX
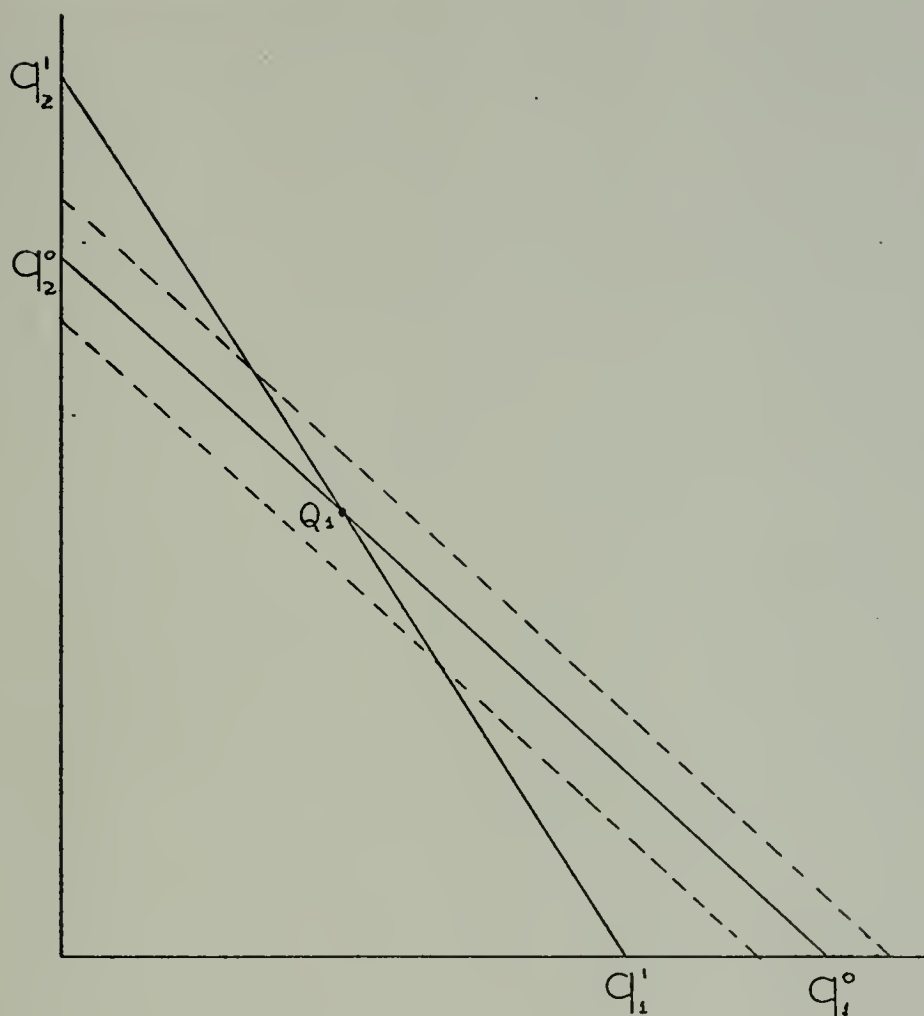
This means the individual is better off in period zero with respect to period one, or the line $q_1^0 \, q_2^0$ passes to the right of the point Q_1.

The actual CPI, as we will discuss in the next chapter, often has a base year which is not chosen to be the first or the last year in the period under consideration. If so, the CPI is neither a pure Paasche nor a pure Laspeyres index.

III. THE CONSTRUCTION OF THE CPI IN THE UNITED STATES

In the second chapter, the theory behind the Consumer Price Index was reviewed and its economic basis was explained. In this chapter the definition of the CPI will first be given. Then the way in which the actual CPI is obtained will be presented in some detail. In the next chapter some of these concepts will be used to calculate the Consumer Price Index for the military (MCPI).

The CPI is a statistical measure of changes in prices of goods and services purchased by urban wage earners and clerical workers including families and single persons.[3] This index does not indicate how much families actually spend. It only measures the changes in the cost of a fixed market basket of goods and services. The CPI has always been associated with the measurement of inflation. That is why the CPI is also called the "Cost of Living Index." Only the changes in the prices of certain consumption items are represented by the CPI. These items include food, clothing, housing, household supplies, automobiles, fuel, recreational goods, fees to doctors and lawyers, beauty shops, rent, transportation fares repair costs, and public utility rates. It includes the sales taxes and excise taxes but does not include income or other personal taxes because these are not associated with the price of specific goods and services.

The office in charge of the collection of the data and calculation of the CPI is the United States Bureau of Labor Statistics. They began to publish indices for individual cities in 1919 but the first regular publication of the average indices of the U. S. city was not begun until

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[3]B.L.S. Handbook of Methods (BLS bulletin 1517 revised 1972).

1921. Since people's buying habits change substantially over time, in
the mid 1930's a new study was made covering expenditures in the years
1934-36. This study provided the basis for a revised index in 1940 with
retroactive calculations back to 1935. During World War II the index
weights were adjusted to reflect the temporary shortages of some goods.
In 1950, the Bureau made another adjustment. This was followed by the
first comprehensive post-war revision of the index which was finished in
1953. Many improvements in pricing methods and calculation were included
in that year. The last comprehensive revision of the index was finished
in January 1964.

In this last revision two significant improvements were made: (1)
The application, to the maximum extent possible, of the principle of prob-
ability sampling and (2) Provision was made for the computation of or at
least a rough estimate of sampling error for the CPI through a system of
replicated samples. In this revision the Bureau made a Consumer Expendi-
ture Survey (CES) covering the period 1961-63. This survey included 72
urban areas that represented all urban places of the United States (all
of the 50 states). From the 72 cities in the CES 56 were finally chosen
as unique in which to obtain price quotations for the index. (In Appendix
C a list of the 56 urban areas is given.) In the expenditure survey the
Bureau obtained a detailed record of quality, amount and kinds of all goods
and services purchased by each customer unit.[4] They also obtained the a-
mount spent annually on each item. The number of people interviewed was
5497. Of these, 585 were single workers and 4912 were urban wage earners
and clerical families.

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[4]A customer unit is considered a family or a single person living
alone.

The Bureau is planning to review and revise the index approximately every 10 years. They are actually making a new major revision in 1974.

The collection of construction data is accomplished using the Consumer Expenditure Survey form published by the B.L.S. The prices of the commodities in the index are obtained in the 56 areas, by personal visit. Almost 18,000 stores and service establishments were included as a smaple for goods and services. About 40,000 tenants formed the sample for rental rates.[5]

The term "market basket" is used to denote all the goods and services consumed by a household. This market basket is composed of about 400 items. It is important to point out that not all items are priced in every city. To estimate the sampling error, two sub-samples of items are taken. These are priced in different cities and in different outlets. The most important goods and services and a sample of the less important ones are included in the calculation. Combinations of these items represent all items purchased. The quality and quantity of the items included in the market basket are kept unchanged between major revisions of the index. Therefore the movement of the index from month to month is only due to changes in prices. The items included in the index are classified into five major groups: food, housing, apparel and upkeep, transportation and health and recreation. For each of the major groups, a separate price index (P.I.) is calculated.[6]

The all items index or CPI combines the five group indices. The CPI is not a simple average of the five PI's since these are of unequal

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[5]BLS - "The consumer price index - A short description" 1971.

[6]BLS also constructs indices for many sub-groups.

importance in terms of expenditure. For example, a given percent change in the food index will affect the all items index more than the same percent change in the clothing index. This is due to the fact that food items have greater importance in the market basket than clothing.

The base period of the index is usually a year or period of years representing relatively normal economic activity. The CPI for any city is actually calculated by adjusting the cost of the U. S. market basket periodically to allow for variations of prices of the items contained in it. Then its adjusted cost is compared with its cost in the base period. This index is a weighted average of price changes. These weights, which are based on annual consumer expenditures, are kept constant over the time period. The index measure price changes as they occur and it is not adjusted for seasonal variations.

The formula used to calculate the index is:

$$R_n = \frac{\sum_i (P_i^n \, Q_i^0)}{\sum_i (P_i^0 \, Q_i^0)} \times 100 \tag{3-1}$$

Where:

R_n is the index in a given period of time

P_i^n is the average price at all outlets of an item in period "n" (given period)

P_i^0 is the average price of an item in the base period "0"

Q_i^0 is the amount of an item included in the market basket in the base period "0."

This relation is known as the "Laspeyres Index" and is named after Etienne Laspeyres, a German statistician and economist. This formula calculates the price index as a weighted aggregate using fixed quantity weights,

usually of the base year. The concept of a weight is that of a number which measures the relative importance of an item when several items are averaged together. Another index that is known as the dollar weighted average of relative prices is often used.

$$ R_n = \frac{\sum\limits_{i} \left(P_i^0 \ Q_i^0 \ \dfrac{P_i^n}{P_i^0} \right)}{\sum\limits_{i} \left(P_i^0 \ Q_i^0 \right)} \tag{3-2} $$

Where:

$\sum\limits_{i} \left(P_i^0 \ Q_i^0 \right)$ is the cost of the market basket in the base period.

$\dfrac{P_i^n}{P_i^0}$ is the price ratio used to adjust the cost of each item; i.e., a weight applied to $P_i^0 \ Q_i^0$ corresponding to the ith item. A version of this index will be used later. The actual CPI is not a pure Laspeyres index because the base year for the prices of the commodities and services was 1967 while the base period for the weights was 1961-63.

A. USES AND LIMITATIONS OF THE INDEX

Throughout its history the index has been used extensively in the evaluation and adjustment of wages. For this reason it has been subjected to repeated public scrutiny. The index is also employed widely in other types of contract-escalation provisions, such as those concerning property rentals, service contracts, annuities and pensions, welfare allowances, alimony payments, etc.

The CPI is used extensively as a guide to public economic policy decisions such as administration of wartime price and rent controls, establishment of income and excise tax rates, and generally as a measure of

inflation in the determination of various fiscal, public finance, international trade and monetary policies.[7] It is used in calculating changes in real earnings. Its component indexes are essential statistical tools for deflation of the national accounts.

Among the limitation of the index is that it is not an exact measure of the changes of prices. Sometimes the people who give market basket information do not report accurately. Similarly there are limitations on the price accuracy of the index.

B. GEOGRAPHIC REPRESENTATION

Due to the fact that the BLS cannot feasibly sample all the cities in the country, the collection of price data for the CPI is centered upon 56 metropolitan areas and urban places. For the 18 largest Standard Metropolitan Statistical Areas, (SMSA), according to the 1960 Census, the weights are based only on their respective population. For the 38 remaining cities, the weights represent not only their own population but also the population of all cities of approximately the same size and that are located in the same region. In other words, the 18 largest SMSA were included in the sample with certainty and the other 38 were selected by probability sample methods to represent all the other urban places in the U. S.

For obtaining the CPI, the U. S. is divided into four strata,

    Stratum A: The twelve largest SMSA (population over 1,400,000)

    Stratum B: Other SMSA with urban population of over 250,000

    Stratum C: SMSA with urban population of 50,000 to 250,000

    Stratum D: Nonmetropolitan urban places with population less

        than 50,000 but more than 2,500

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[7]BLS Bulletin 1517

This classification has the peculiarity that the three first strata correspond to the metropolitan segment of the urban population while strtum D corresponds to the nonmetropolitan segment.

With the objective of having a good geographic dispersion, the selection of the specific cities were accomplished using the four census regions: Northeast, North Central, South and West as geographic areas. The allocation was as follows:[8]

	Stratum A*	B	C	D	All Three Probability Strata
Northeast	5	2	2	3	7
North Central	5	3	3	5	11
South	-	3	4	6	13
West	2	2	1	2	5
Total 48 states	12	10	10	16	36

Alaska and Hawaii were considered separated and included later in the sample.

C. COMMODITY REPRESENTATION

The commodity representation includes goods and services purchased by an "average" family for living. For the CPI, all the goods and services bought by consumers are classified into five groups each of which has sub-groups. These groups and sub-groups are used as a sampling for selection of items and derivation of weights. The lowest grouping level is called the expenditure class (E.C.). It defines the level at which the weight of the expenditures for the base period will be held constant between major revisions of the CPI. Items are grouped within an E.C. in

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[8]BLS Bulletin 1517.

*The six largest SMSA are not included in this strata.

such a way that their physical characteristics are as similar as possible.
The five groups with their respective E.C.'s are enumerated in Appendix D.
As can be seen in this Appendix, there are 52 E.C.'s and 812 items includ-
ed in the survey list. The samples were selected on a national basis and
two replicated samples of items were selected with probability proportion-
al to the relative importance of the expenditure for the item compared to
the total expenditure for all items.

IV. WHY A MILITARY CPI?

The purpose of this chapter is to explore the possibility of obtaining
a consumer index for military personnel taking into account that military
personnel and their dependents obtain goods and services at reduced prices
or in some cases free.[9]

What are the particular commodities and services that are given free
or with some discount to the military? The first important item to be
considered is housing. According to the CPI weights, housing corresponds
to about one-third of the expenses of an average family. Housing for un-
married enlisted personnel and bachelor officers is given completely free.
The married personnel that live on the military bases without families al-
so have free housing. At most of the large military bases there exists
housing facilities for married officers and married enlisted personnel
that live with their families. In this housing the only costs they pay
are electricity, gas and telephone. At the bases where the housing facil-
ities are not adequate for the quantity of military people living in the
area, the officers and enlisted who cannot use the housing facility re-
ceive an allowance or subsidy. This subsidy does not represent a com-
plete housing subsidy in many cases, especially among those who wish to
have a better house. It is however quite an advantage with respect to the
civilians who don't receive any housing allowance at all.

Another important item is medical care. This amounts to 5.7% of the
annual expenses for an average civilian household, but it is given com-
pletely free to the military personnel and their dependents. Only dental

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[9]For a list of these items see Appendix B.

services have to be paid for the military dependents and this service is free for wives when they are pregnant. Retired military personnel also receive free medical attention and hospitalization. The medicines prescribed by doctors at the military hospitals and dispensaries are also given free to the patients. In most of the large military bases and also in some of the small ones, there are programs of flouride treatment, vaccination, and annual medical examinations that are given at no cost to the military personnel and their dependents. Active duty personnel receive two pair of glasses if recommended by the optometrist.

The next item to be considered in this analysis is food. In this case the discount obtained at the commissaries by the military personnel is between 30 to 50% compared with the prices in other food stores. This percentage is important because food expenses compromise 22.4% of the total expenses for an average family. In Appendix H the discounts obtained at the commissaries for some selected items are presented.

In addition, at the military exchange, many items included in the groups called apparel and upkeep and personal care can be purchased with a discount that ranges from 20 to 40%. Sales taxes are not paid at the exchanges. According to the current regulations, the exchanges are not allowed to sell items that cost above a given limit. This might result in the situation where the highest quality items cannot be bought in these stores. Also some household appliances such as refrigerators, stoves, washers, dryers, and all kind of furniture are not included in the list of items that can be obtained at the military exchanges. These limitations suggest that variations in the E.C.'s included in the groups apparel and upkeep and personal care may not affect the calculation of the MCPI as much as the food discount.

Some other services are obtained free by military personnel. For example, funeral services for the personnel on active duty, legal services in some aspects such as writing wills and giving legal advice.

In summary it can be said that the main differences in expenses between civilian and military are: housing, medical care, food and some articles obtained at the exchanges. A military cost of living or price index can be obtained using the ideas given in this chapter. The weights of the groups of items in the MCPI are not the same as the CPI. The CPI could be modified using weights corresponding to the actual expenditures of military personnel. Without data a reweighting procedure is the key point for the calculations to obtain a military CPI. Our method will be explained in detail in Chapter V. The resulting modified index for the military could be used to adjust military wages in the same way the CPI is used to adjust wages for civilian .

V. COMPUTATIONAL PROCEDURE FOR THE MCPI

In this chapter all the calculations involved in obtaining the Consumer Price Index for Military Personnel are developed. The results are presented in the text in the form of graphs and partial tables, the detailed tables are included in the appendix.

This chapter is divided into three sections: In the first one a military index is constructed based only on the commodities military personnel obtain free, such as housing[10] and medical care.

The first commodity to be excluded (considered free) will be housing, then medical care and finally both. In the first case the income elasticity for all the items will be considered unitary.[11]

In the last two cases, the calculations include two different situations for housing:

a) Income elasticities unitary

b) Variable income elasticities

In the second section of this chapter, the construction of the MCPI based on the geographic distribution of Military Bases and Stations is presented,[12] for this calculation the 1960 U.S. Census and the 1960 Navy population was used.

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[10]As it is discussed in Chapter IV housing is not given completely free in all the cases.

[11]The income elasticity for medical care is too unstable, H.S. Housthakker and Lester D. Taylor, "Consumer Demand in the U.S." 1929-1970.

[12]Only the geographic distribution of the Naval bases and stations will be used here.

In the third section an example will be presented to show the possible effect on the MCPI of the discount on food. Here also the effect of income elasticity will be considered in the same two cases as in the first part of this chapter: unitary income elasticity and variable income elasticities.

A. CONSTRUCTION OF THE MCPI BASED ON FREE COMMODITIES

1. MCPI Free Housing Only

As it was explained in Chapter III the major commodities the military personnel obtain at no cost are housing and medical care; it was also pointed out that in some cases housing is not a completely free item but for the purpose of this thesis this last consideration will not be included. First let's see what happens to the CPI if the housing expenses are considered completely free. The weight of housing expenses that compromise 33.2% of the salary of an average people will be redistributed among the reamining groups of commodities. In this case, all the income elasticities will be assumed to be unitary.

The formula used to obtain the new weight for the remaining commodities is:[13]

$$W_i' = \frac{W_i}{\sum\limits_{i=1}^{n} W_i - \sum\limits_{j=1}^{m} W_j} \qquad m < n \qquad\qquad (5\text{-}1)$$

Where

W_i' = redistributed weight for commodity i

W_i = original weight for commodity i

W_j = weight of the commodity considered free (housing in this case)

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[13] The derivation of this formula is given in Appendix F.

$$\sum_{i=1}^{n} W_i = \text{total weight } (=1.00)$$

To get the MCPI for year "j" the following relation is used:

$$\Sigma(W_{ij}) \cdot (PI_{ij}) = (MCPI_j) \tag{5-2}$$

Where

W_{ij} = redistributed weight for commodity "i" in year "j"

(PI_{ij}) = price index for commodity "i" in year "j"

$(MCPI_j)$ = military price index for year "j"

The results obtained are:[14]

TABLE 5-1

Year	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
Index										
CPI	89.60	90.60	91.30	92.90	94.50	97.20	100.00	204.20	109.80	116.30
$(MCPI)_h$	88.99	90.20	91.39	92.37	94.34	97.36	100.00	103.72	109.36	114.84

In Table 5-1 it can be seen that in all the years with the exception of 1963 and 1966, the $(MCPI)_h$ is smaller than the CPI. From table 5-1a the following conclusions can be drawn:

a) The percentage of variation year by year for the CPI is greater than for the $(MCPI)_h$ during the years periods from 1963 to 1964, 1966 to 1967, 1967 to 1968 and 1969 to 1970. In the remaining years the opposite is true. To see this results in Table 5-1a check the main diagonal elements, taking the first year from the row and the second year from the column. For example, the percentage change from 1963 to 1964 are 1.31 for the CPI and 1.07 for the $(MCPI)_h$.

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[14]For all the complete tables see Appendix G

FIG. 5—1

MCPI CONSIDERING FREE HOUSING
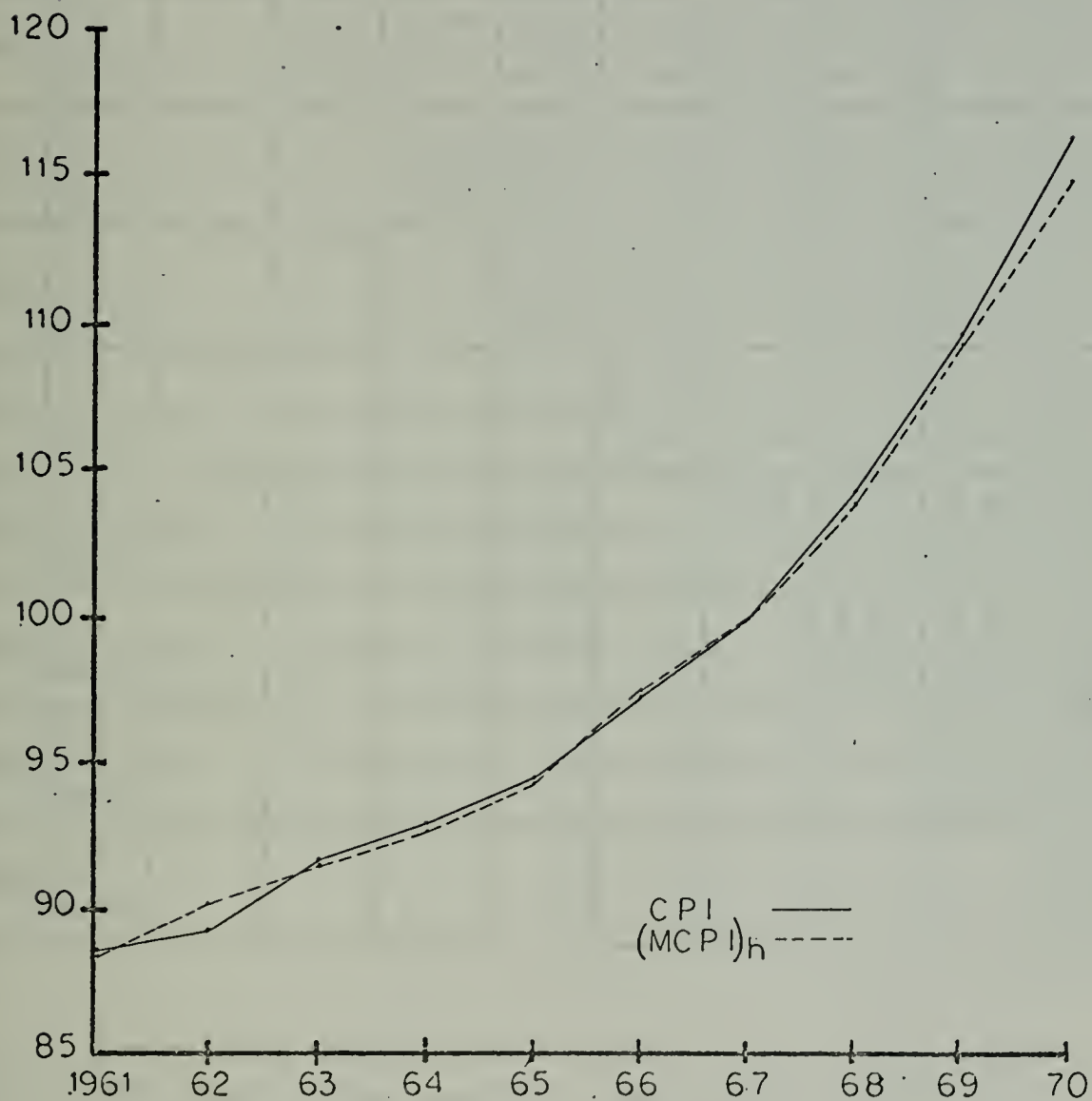
TABLE 5-1a
PERCENTAGE OF VARIATION FOR THE CPI AND $(MCPI)_h$

		1962	1963	1964	1965	1966	1967	1968	1969	1970
1961	CPI	1.12	2.34	3.68	5.42	8.48	11.61	16.29	22.54	29.8
	MCPI	1.36	2.70	3.80	6.01	9.41	12.37	16.55	22.89	29.05
1962	CPI		1.21	2.54	4.30	7.28	10.38	15.01	21.19	28.37
	MCPI		1.32	2.41	4.59	7.94	10.86	14.99	21.24	27.32
1963	CPI			1.31	3.05	6.00	9.05	13.63	19.74	26.83
	MCPI			1.07	3.23	6.53	9.42	13.49	19.66	25.66
1964	CPI				1.72	4.63	7.64	12.16	18.19	25.19
	MCPI				2.13	5.40	8.26	12.29	18.39	24.33
1965	CPI					2.86	5.82	12.26	16.19	23.07
	MCPI					3.20	6.00	9.94	15.92	21.73
1966	CPI						2.88	7.20	12.96	19.65
	MCPI						2.71	6.53	12.33	17.95
1967	CPI							4.2	9.8	16.3
	MCPI							3.72	9.36	14.81
1968	CPI								5.37	11.61
	MCPI								5.44	10.72
1969	CPI									5.92
	MCPI									5.01

NOTE — To check the annual percentage change use the main diagonal elements.

b) The total percentage change during the 10-year period is given in the first row and last column element of the matrix. In this case the values are 29.80 for the CPI and 29.05 for the $(MCPI)_h$.

c) The percentage of variation during the period 1967 to 1970 is based on a pure Laspeyres index because the base year is 1967. These percentages are 16.3 for the CPI and 14.84 for the $(MCPI)_h$ which are given in the row for 1967 and the column for 1970.

Note: Case (a) and (b) are not based on either a pure Laspeyres or a pure Paasche index.

2. MCPI Free Medical Care Only

The second step will be to consider free medical care only; an average family spends about 5.7% of their income in medical expenses. This step will be subdivided in two parts as follows:

a. All Income Elasticity Unitary

The calculations for this part are exactly the same as the case of free housing. The results are as follows:

TABLE 5-2

Year	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
Index										
CPI	89.60	90.60	91.70	92.70	94.50	97.20	100.00	104.20	109.80	116.30
$(MCPI)_m$	90.12	91.13	92.20	93.41	94.82	97.54	100.00	104.10	109.62	116.04

As it can be seen in Table 5-2 the $(MCPI)_m$ for all the years before the base year are greater than the CPI and after that the opposite situation occurred. From Table 5-2a, the percentage changes year by year for the $(MCPI)_m$ is greater than the percentage change for the CPI only in the period from 1965 to 1966 (2.87 vs 2.86 respectively). The total percentage change is 29.8 for the CPI and 28.76 for the $(MCPI)_m$. The

FIG. 5-2

MCPI CONSIDERING FREE MEDICAL CARE (UNITARY-ELASTICITIES)
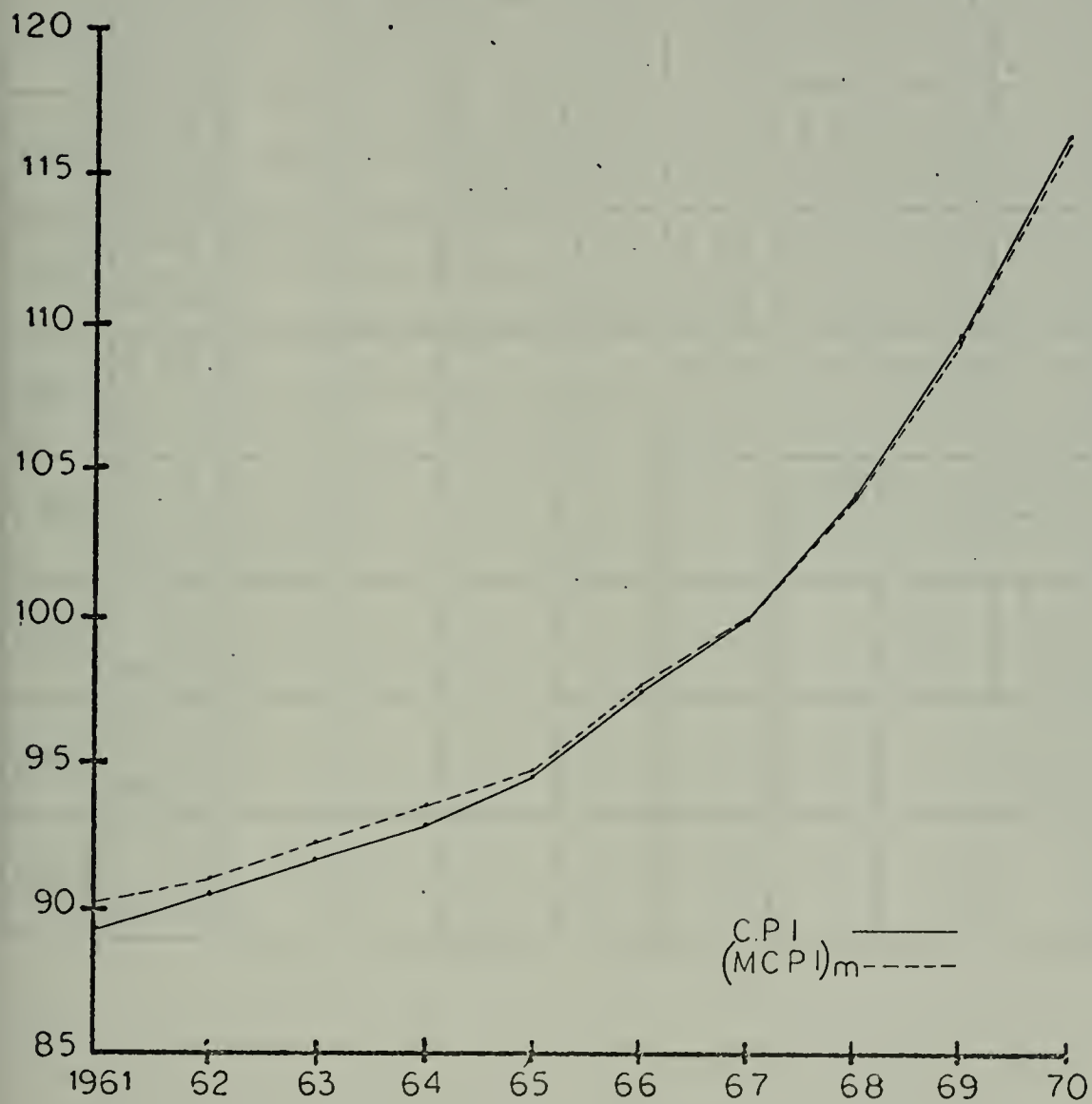
TABLE 5-2a
PERCENTAGE OF VARIATION FOR THE CPI
AND $(MCPI)_m$

		1962	1963	1964	1965	1966	1967	1968	1969	1970
1961	CPI	1.12	2.34	3.68	5.42	8.48	11.61	16.29	22.54	29.8
	MCPI	1.12	2.31	3.65	5.22	8.22	10.96	15.51	21.64	28.76
1962	CPI		1.21	2.54	4.30	7.28	10.38	15.01	21.19	28.37
	MCPI		1.17	2.50	4.05	7.03	9.73	14.23	20.29	27.33
1963	CPI			1.31	3.05	6.00	9.05	13.63	19.74	26.83
	MCPI			1.31	7.84	5.79	8.46	12.91	18.89	25.86
1964	CPI				1.72	4.63	7.64	12.16	18.19	25.19
	MCPI				1.51	4.42	7.05	11.44	17.35	24.23
1965	CPI					2.86	5.82	12.26	16.19	23.07
	MCPI					2.81	5.46	9.79	15.61	22.38
1966	CPI						2.88	7.20	12.96	19.65
	MCPI						2.52	6.73	12.38	17.94
1967	CPI							4.2	9.8	16.3
	MCPI							4.1	9.62	16.04
1968	CPI								5.37	11.61
	MCPI								5.30	11.47
1969	CPI									5.92
	MCPI									5.86

percentage of variation for the Laspeyres index is 16.3 for the CPI and 16.04 for the $(MCPI)_m$.

    b. Variable Income Elasticity

    The following elasticities[15] will be used for the groups and main sub-groups of items:

Group of Items	Income[16] Elasticity
– Food	0.34
– Housing	0.912
– Apparel and Upkeep	0.613
– Transportation	1.478
– Personal Care	3.188
– Reading and Recreation	1.8648
– Other Goods and Services	0.776

    The original weight will be modified to include the effect of the income elasticity. To accompliah this, the following relation will be used[17]:

$$W_i' = (1 + \eta_{I_i}\, y)\, W_i \qquad\qquad (5\text{-}3)$$

Where:

    W_i' = reweighted value for commodity i,

    η_{I_i} = income elasticity for commodity i,

    W_i = original weight of commodity i

    y   = increasing in income level due to obtaining some commodity free.

---

[15] H.S. Houthakker and Lester D. Taylor, "Consumer Demand in the U.S. 1929-1970."

[16] For a detailed list see Appendix G, Table III.

[17] For derivation of the formulas 5-3 and 5-4 see Appendix F.

The value of "y" is calculated using the following formula:

$$y = \frac{\sum\limits_{j}^{m} W_j}{\sum\limits_{i=1}^{n} W_i - \sum\limits_{j}^{m} W_j} \tag{5-4}$$

Where:

W_j = Weight of commodity assumed free.[18]

The reweighted value W_i will be used to obtain the MCPI for year "j" applying the formula 5-2. The results are given in Table 5-3.

TABLE 5-3

Year Index	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
CPI	89.60	90.60	91.70	92.90	94.50	97.20	100.00	104.20	109.80	116.30
$(MCPI)_m$	90.13	91.16	92.22	93.43	94.84	97.53	100.00	104.10	109.61	116.01

$(MCPI)_m$ = MCPI considering free medical care and elasticities not unitary.

In table 5-3 we see that before the base year, the $(MCPI)_m^1$ is greater than the CPI for all years, and the opposite situation happens in the years after the base year. From Table 5-3a the percentage changes year by year for the CPI are greater than the $(MCPI)_m^1$ in all the years except from 1961-1962. And the percentage changed over the 10 years are 29.80 for the CPI and 28.71 for the $(MCPI)_m^1$. The percentage changed from 1967 to 1970 which is taken from the pure Laspeyers index are 16.3 for the CPI and 16.01 for the $(MCPI)_m^1$.

3. MCPI Free Housing and Medical Care

Now, both housing expenses and medical care are considered free. Here also the analysis will be divided in two parts as follows:

---

[18]From the theorem 1, Appendix F, weight of medical care (W_m) should equal income elasticity of medical care (η_{I_m}) times its weight, i.e. $W_m = \eta_{I_m} W_m$. Which means that η_{I_m} must be I_m approximately unity.

FIG.   5—3

MCPI   CONSIDERING   FREE   MEDICAL   CARE

AND   ELASTICITIES   NOT   UNITARY

35
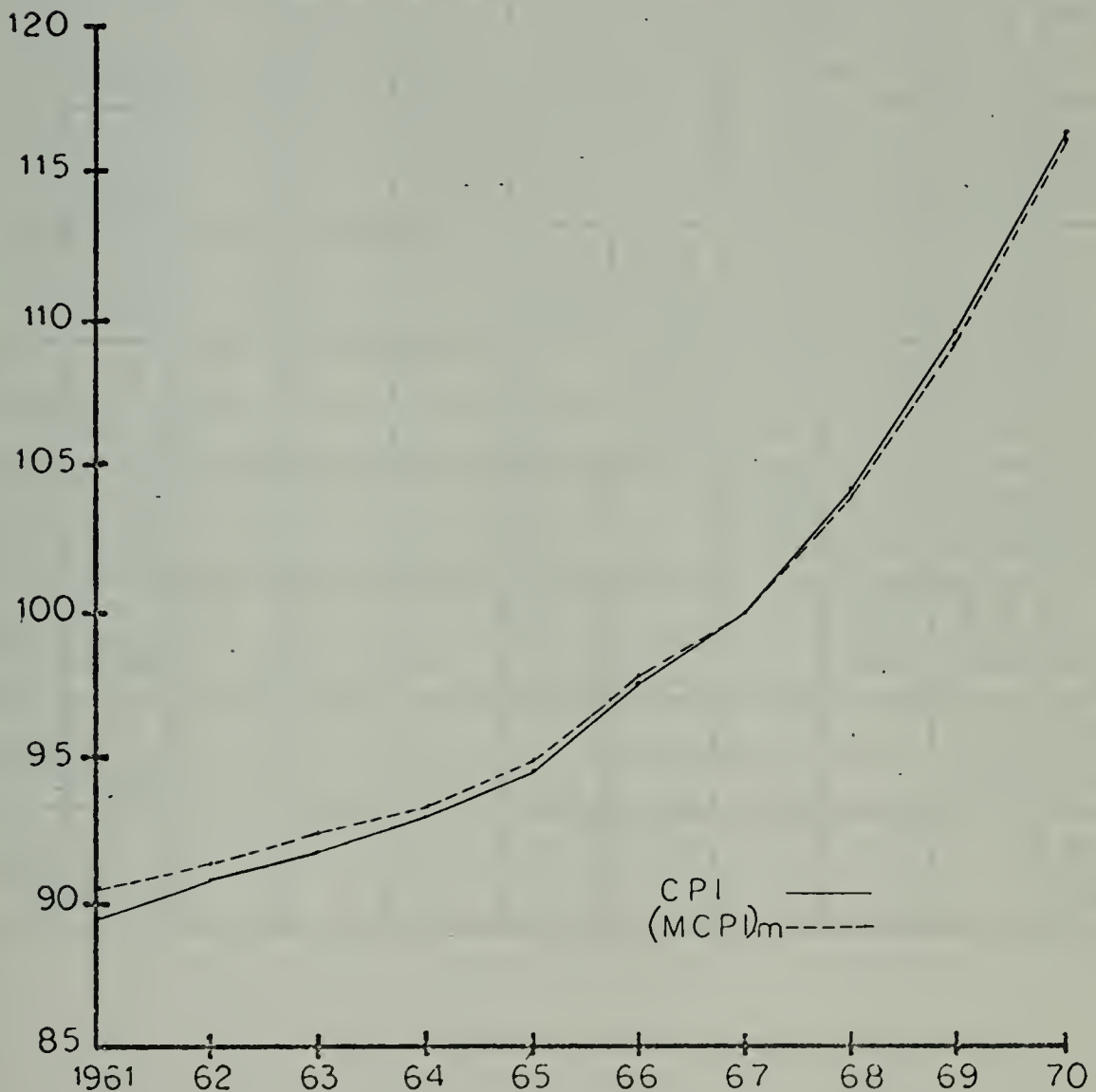
TABLE 5-3a

PERCENTAGE OF VARIATION FOR THE CPI AND $(MCPI)'_m$

		1962	1963	1964	1965	1966	1967	1968	1969	1970
1961	CPI	1.12	2.34	3.68	5.42	8.48	11.61	16.29	22.54	29.8
	MCPI	1.14	2.32	3.66	5.23	8.21	10.95	15.50	21.61	28.71
1962	CPI		1.21	2.54	4.30	7.28	10.38	15.01	21.19	28.37
	MCPI		1.16	2.49	3.68	6.99	9.7	14.19	20.24	27.26
1963	CPI			1.31	3.05	6.00	9.05	13.63	19.74	26.83
	MCPI			1.31	2.84	5.76	8.44	12.88	18.86	25.80
1964	CPI				1.72	4.63	7.64	12.16	18.19	25.19
	MCPI				1.51	4.39	7.03	11.42	17.32	24.17
1965	CPI					2.86	5.82	12.26	16.19	23.07
	MCPI					2.84	5.44	9.76	15.57	22.32
1966	CPI						2.88	7.20	12.96	19.65
	MCPI						2.53	6.74	12.39	18.95
1967	CPI							4.2	9.8	16.3
	MCPI							4.1	9.61	16.01
1968	CPI								5.37	11.61
	MCPI								5.29	11.44
1969	CPI									5.92
	MCPI									5.84

a. All Income Elasticity Unitary

In this case formula 5-1 is employed to redistribute the weight of housing (33.2) and medical care (5.7) among the remaining groups of commodities. Formula 5-2 is used to calculate the MCPI considering free housing and medical care: $(MCPI)_{hm}$. The results are given in Table 5-4

TABLE 5-4

Year	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
Index										
CPI	89.60	90.60	91.70	92.90	94.50	97.20	100.00	104.20	109.80	116.30
$(MCPI)_{hm}$	89.70	90.83	91.93	93.20	94.78	97.73	100.00	104.05	108.98	114.48

$(MCPI)_{hm}$ = Military CPI considering free housing and medical care.

In Table 5-4 we see that before the base year the $(MCPI)_{hm}$ is greater than the CPI and after the base year the opposite is true. From Table 5-4a the percentage change year by year for the $(MCPI)_{hm}$ is greater than the variation for the CPI only during the intervals from 1961 to 1962, 1963 to 1964 and 1965 to 1966. The total percentage of variation in the 10 years is 29.8 for the CPI and 29.63 for the $(MCPI)_{hm}$. The percentage change for the pure Laspeyre index is 16.3 for the CPI and 14.48 for the $(MCPI)_{hm}$.

b. Variable Income Elasticity

Formulas 5-3[19] and 5-4 will be used here to get a reweighted index. Applying the reweighted values in the formula 5-2, the MCPI with free housing and medical care and income elasticity not unitary, $(MCPI)_{hm}^{1}$

---

[19]From theorem 1, Appendix F, $W_m + W_R = \eta_{I_m} W_m + \eta_{I_h} W_R$. Here, W_m=5.7, W_R=33.2, η_{I_h}=0.912, η_{I_m} is undetermined. Hence, to satisfy this condition, some range of variation has to be allowed. This range is 1.51 to 1.65 for η_{I_m} i.e. $1.51 - \eta_{I_m} - 1.65$. Then W_m+W_H will vary from 38.5 to 39.3. This is done because according to H.S. Houthakker and Lester Taylor, the income elasticity for medical care (7.5) is very flexible in those years.

37

FIG. 5—4

$(MCPI)_{hm}$ WITH UNITARY INCOME ELASTICITY

CPI ———
$(MCPI)_{hm}$ ------
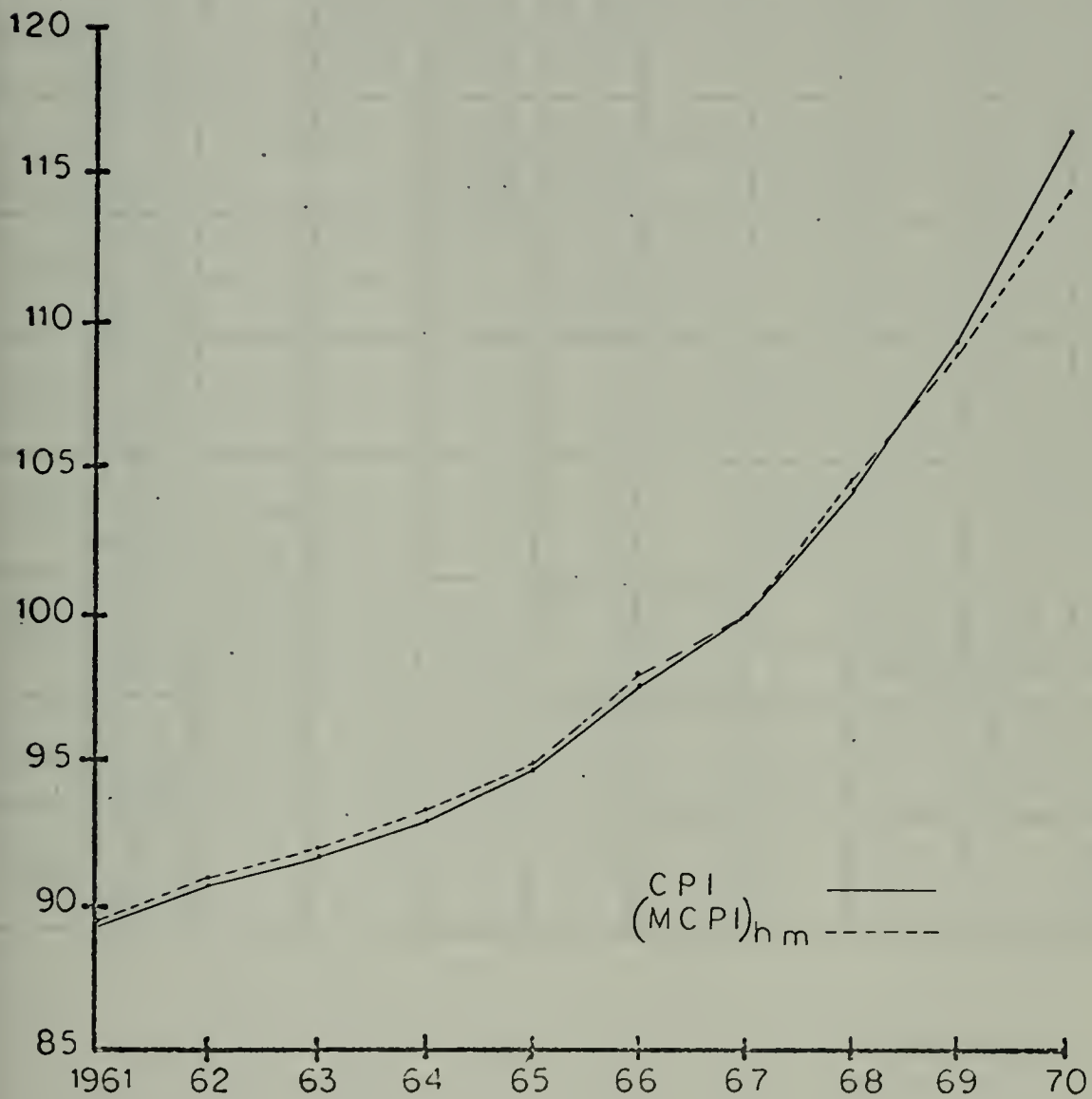
TABLE 5-4a
PERCENTAGE OF VARIATION FOR THE CPI AND $(MCPI)_{hm}$

		1962	1963	1964	1965	1966	1967	1968	1969	1970
1961	CPI	1.12	2.34	3.68	5.42	8.48	11.61	16.29	22.54	29.8
	MCPI	1.25	2.49	3.90	5.66	8.95	11.48	16.00	21.49	27.63
1962	CPI		1.21	2.54	4.30	7.28	10.38	15.01	21.19	28.37
	MCPI		1.21	2.61	4.35	7.60	10.10	14.55	19.98	26.04
1963	CPI			1.31	3.05	6.00	9.05	13.63	19.74	26.83
	MCPI			1.38	3.10	6.31	0.78	13.18	18.55	24.53
1964	CPI				1.72	4.63	7.64	12.16	18.19	25.19
	MCPI				1.70	4.86	7.30	11.64	16.93	22.83
1965	CPI					2.86	5.82	12.26	16.19	23.07
	MCPI					3.11	5.51	9.78	14.90	20.78
1966	CPI						2.88	7.20	12.96	19.65
	MCPI						2.32	6.47	11.51	17.14
1967	CPI							4.2	9.8	16.3
	MCPI							4.05	8.98	14.48
1968	CPI								5.37	11.61
	MCPI								4.74	10.02
1969	CPI									5.92
	MCPI									5.05

will be obtained.   The results are as follows:

TABLE 5-5

Year	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
Index										
CPI	89.60	90.60	91.70	92.90	94.50	97.20	100.00	104.20	109.80	116.30
$(MCPI)^1_{hm}$	89.81	91.08	92.15	93.46	94.96	97.58	100.00	104.04	108.85	114.23

$(MCPI)^1_{hm}$ = MCPI considering free housing and medical care and elasticities not unitary.

In Table 5-5 the $(MCPI)^1_{hm}$ is higher than CPI for the period before the base year and lower for the period after that. From Table 5-5a the percentage change year by year for the $(MCPI)^1_{hm}$ is greater than the change for the CPI only in the periods from 1961 to 1962 and 1963 to 1964. The total percentage of variation is 29.8 for the CPI and 27.9 for the $(MCPI)^1_{hm}$. The percentage of change for the Laspeyres index 16.3 for the CPI and 14.23 for the $(MCPI)^1_{hm}$.

B.   CONSTRUCTION OF THE MCPI BASED ON GEOGRAPHIC DISTRIBUTION

In this section we construct a MCPI based on the distribution of the Military[20] Bases and Stations. First only the eighteen largest SMSA will be considered to obtain a civilian metropolitan CPI; this is accomplished by redistributing the original weights for the 18 cities, as is given in the BLS Handbook for 1960 and taking their sum as 100 to get the respective new weight for each city.

In Table 7 of the Appendix G are shown the quantities obtained with this reweighting procedure. This modified weight and the original CPI

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[20]The Navy will be used as a representative for the Armed Forces.

FIG. 5—5

MCPI CONSIDERING FREE HOUSING, FREE MEDICAL CARE AND ELASTICITY NOT UNITARY
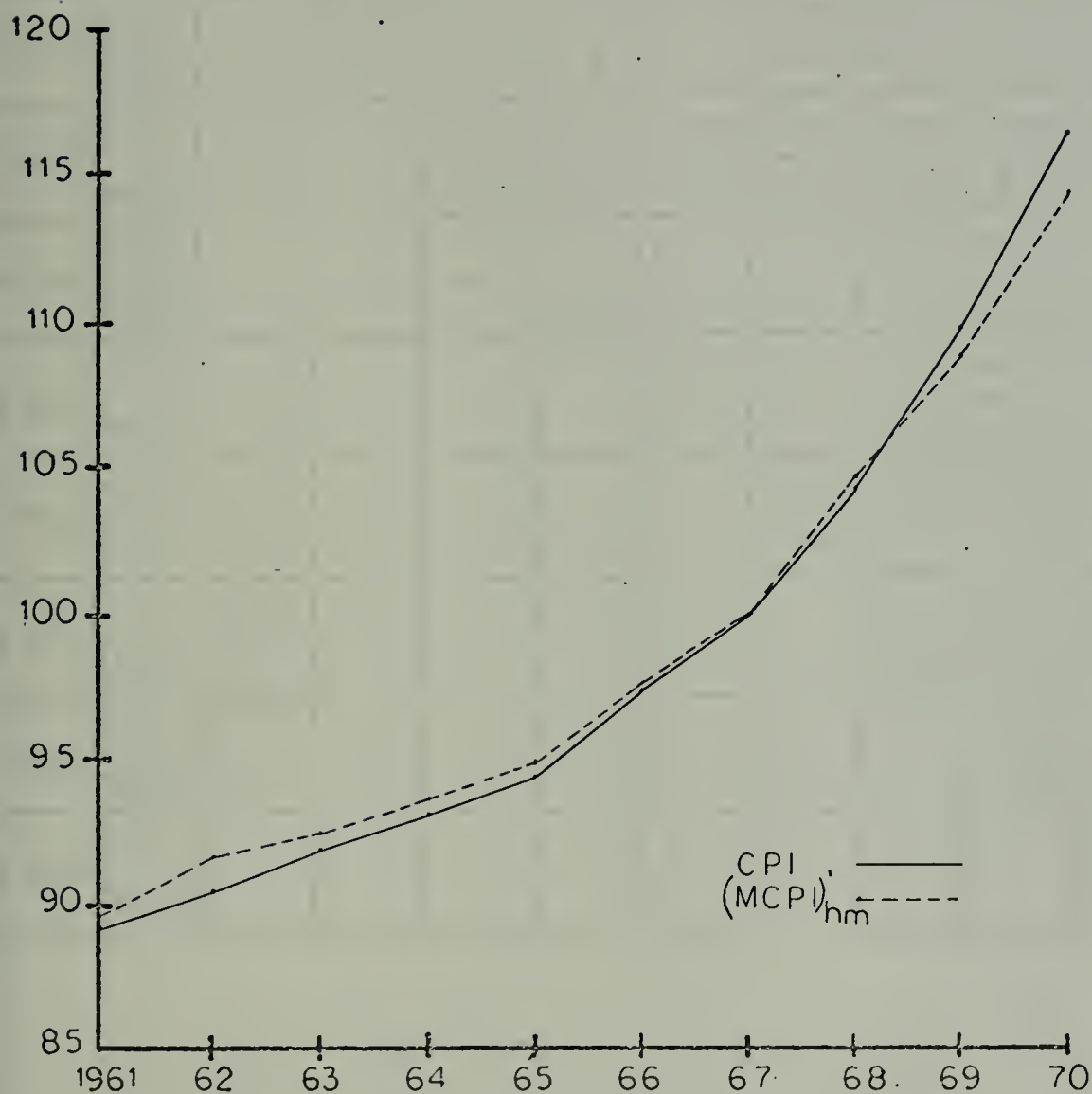
TABLE 5-5a

PERCENTAGE OF VARIATION FOR THE CPI AND $(MCPI)'_{hm}$

		1962	1963	1964	1965	1966	1967	1968	1969	1970
1961	CPI	1.12	2.34	3.68	5.42	8.48	11.61	16.29	22.54	29.8
	MCPI	1.41	2.61	4.06	5.73	8.65	11.35	15.84	21.20	27.19
1962	CPI		1.21	2.54	4.30	7.28	10.38	15.01	21.19	28.37
	MCPI		1.17	2.61	4.23	7.14	9.79	14.23	19.51	25.42
1963	CPI			1.31	3.05	6.00	9.05	13.63	19.74	26.83
	MCPI			1.42	3.05	5.89	8.52	12.90	18.12	23.96
1964	CPI				1.72	4.63	7.64	12.16	18.19	25.19
	MCPI				1.60	4.41	6.70	11.32	16.47	22.22
1965	CPI					2.86	5.82	12.26	16.19	23.07
	MCPI					2.76	5.31	9.56	14.63	20.29
1966	CPI						2.88	7.20	12.96	19.65
	MCPI						2.48	6.62	11.55	17.06
1967	CPI							4.2	9.8	16.3
	MCPI							4.04	8.85	14.23
1968	CPI								5.37	11.61
	MCPI								4.62	9.79
1969	CPI									5.92
	MCPI									4.94

for the 18 cities are used to calculate the new metropolitan CPI, this is done for the years[21] 1964-1970 as is shown in Table 8, Appendix G.

The values obtained here will be employed to calculate the CPI for the remaining 38 cities that complete the sample of 56 used for the Bureau of Labor Statistics to calculate the CPI.

The formula used for this purpose is a very intuitive one, in which it's assumed that total CPI is equal to the sum of their weighted components. In symbols:

$$CPI_j = \sum_{i=1}^{18} (W_{ij})(CPI_{ij}) + (W_{38})(CPI_{38j}) \qquad (5\text{-}5)$$

Where:

CPI_j = CPI for year "j"

W_{ij} = Weight for the "i" city in the year "j"

W_{38j} = Weight for the remaining 38 cities in the year "j"

CPI_{ij}= CPI for the "i" city in the year "j"

CPI_{38j}=CPI for the 38 remaining cities in year "j"

In formula 5-5 the only unknown quantity is CPI_{38j} because the CPI for all items or total CPI and W_{ij} can be taken from the BLS Handbook, CPI_{ij} was just calculated (Table 8, Appendix G) and W_{38} can be obtained subtracting W_{18} from 100. The results obtained from these calculations will form the row 19 of the table 10 of Appendix G that under the name of "others" include the remaining 38 cities.

The next step is to calculate the weight of the Navy populations in each city; this is done using the U. S. Naval Population Distribution for 1960, published by the Department of the Navy. In Table 9, Appendix G are shown the results of this reweighting procedure.

---

[21]The data for the years 1961 to 1963 was not available for some cities.

Now we are in condition to calculate the MCPI due to geographic

distribution: $(MCPI)_g$. The relation to be used is exactly like equation

5-1 with the only difference that the subscript "i" now means city in-

stead of commodity. The complete results are presented in Table 10 of

Appendix E. From that table the following results are taken:

TABLE 5-6

Year Index	1964	1965	1966	1967	1968	1969	1970
CPI	92.90	94.50	97.20	100.00	104.20	109.80	116.30
$(MCPI)_g$	92.92	94.31	97.04	100.00	104.14	109.50	115.90

In Table 5-6 we see that the $(MCPI)_g$ and the CPI are very similar in

the period under consideration, the difference is slightly greater in 1969

and 1970. From Table 5-6a the percentage change year by year for the

$(MCPI)_g$ is greater than the CPI during the periods from 1966 to 1967 and

1968 to 1969. The percentage change over the ten year period is 25.19

for the CPI and 24.52 for the $(MCPI)_g$. The percentage change for the pure

Laspeyre index is 16.3 for the CPI and 15.70 for the $(MCPI)_g$.

C. FOOD DISCOUNT AND THE MCPI

Military personnel receive special treatment in the prices of the com-

modities they buy at the Exchanges and Commissaries; some implications of

this situation for the CPI are analyzed in this section. Specifically,

the case of the Commissary will be taken as an example. Our data was ob-

tained from the Commissary of Fort Ord in Monterey, California. The data

obtained cover the years from 1966 to 1970 and it consists of the percent-

age saving that military personnel experience when buying at this facility.

FIG. 5-6

MCPI FOR GEOGRAPHIC DISTRIBUTION
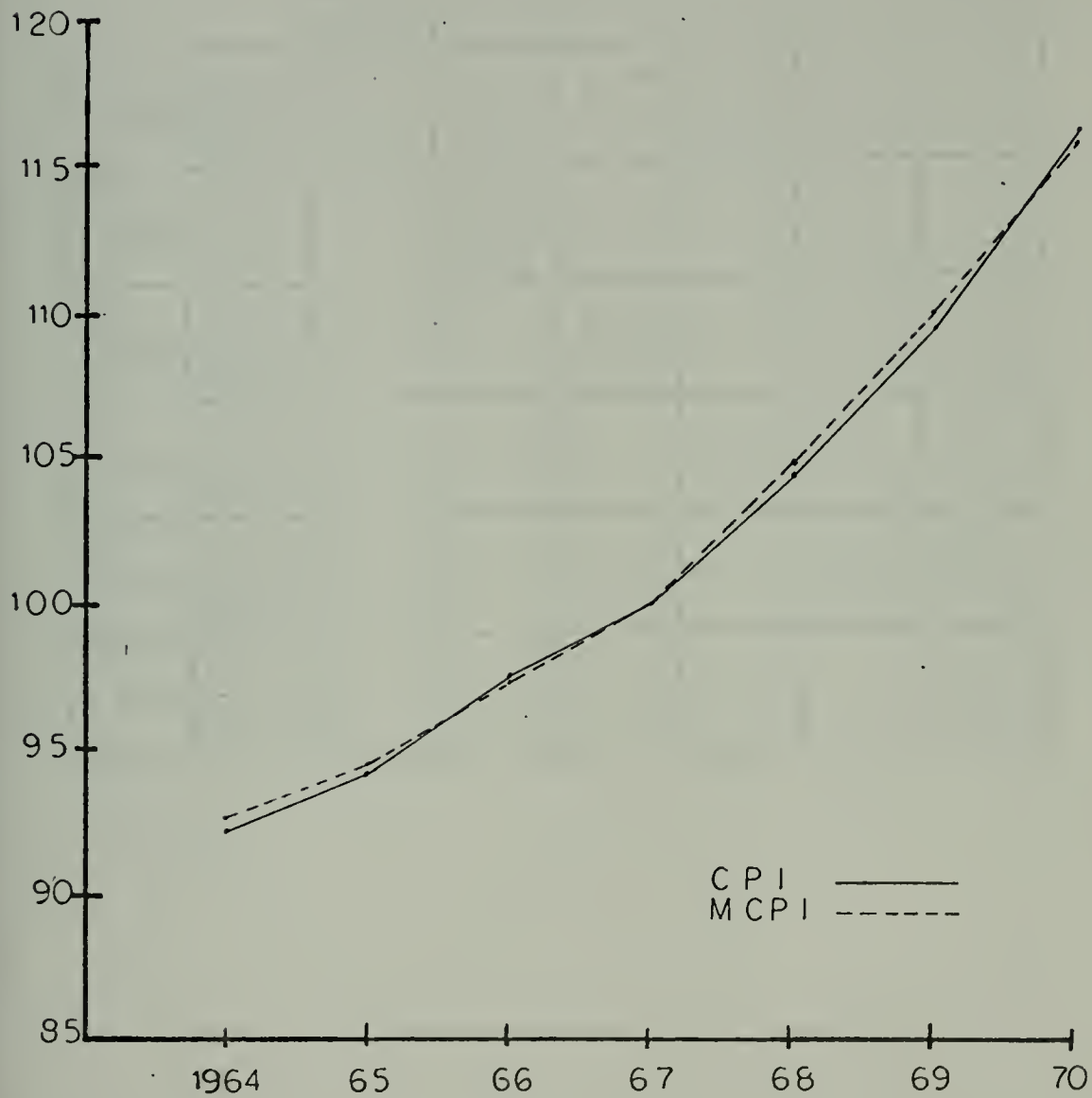
TABLE 5-6a

PERCENTAGE OF VARIATION FOR THE CPI AND $(MCPI)_g$

		1965	1966	1967	1968	1969	1970
1964	CPI	1.72	4.63	7.64	12.16	18.19	25.19
	MCPI	1.71	4.43	7.62	12.07	17.84	24.52
1965	CPI		2.86	5.82	12.26	16.19	23.07
	MCPI		2.68	5.81	10.19	15.86	22.42
1966	CPI			2.88	7.20	12.96	19.65
	MCPI			3.05	7.32	12.84	19.23
1967	CPI				4.12	9.8	16.3
	MCPI				4.14	9.50	15.70
1968	CPI					5.37	11.61
	MCPI					5.45	11.10
1969	CPI						5.97
	MCPI						5.66

The percentage discount obtained at this facility for the years 1966 to 1970 was:[22]

Year	1966	1967	1968	1969	1970
Discount	36.5%	39.4%	31.0%	29.6%	30.5%

In the following calculations the MCPI to be considered will include free housing, free medical care and food discount, and for convenience will be denoted by $(MCPI)_f$. To get the $(MCPI)_f$ it is necessary first to calculate the value of the MCPI considering only food discount with the following relation:[23]

$$(MPI)_f = PI_f \frac{D_i}{D_0} \tag{5-6}$$

Where:

PI_f = price index for food

MPI_f = military price index for food

D_i = 1 - (discount in year "i")

D_0 = 1 - (discount in base year)

In Table 5-7 we show the results of the application of the formula 5-6 for the years 1966 to 1970.

TABLE 5-7.   Calculation of the $(MPI)_f$

	1966	1967	1968	1969	1970
Original CPI (Food)	99.1	100.0	103.6	108.9	114.9
$\dfrac{D_i}{D_0}$	1.048	1.0	1.138	1.161	1.147
(MCPI)	103.8	100.0	117.9	126.4	131.8

---

[22]Source: "Analysis of Miscellaneous Data From The Annual Survey of the Fort Ord Commissary Store" - for more details see Appendix H.

[23]See Appendix E for the derivation of this formula.

This section will be divided in two parts: (1) considering all the income elasticities unitary and (2) variable income elasticities.

1. All Income elasticity unitary

The values obtained using the formula 5-6 and presented in Table 5-7 will become the row corresponding to food in Table 11, Appendix G. With this value included, equation 5-2 yields the results in 5-7.

TABLE 5-7a

Year Index	1966	1967	1968	1969	1970
CPI	97.20	100.00	104.20	109.80	116.30
$(MCPI)_f$	99.45	100.00	109.29	115.40	120.68

$(MCPI)_f$ = MCPI including free housing, medical care, food discounts and unitary income elasticities.

In Table 5-7a we can see that the $(MCPI)_f$ is greater than the CPI in all the years under consideration except the base year. From Table 5-7b the percentage change year by year for the CPI is greater than the percentage change for the $(MCPI)_f$ during the period from 1966 to 1967 and from 1969 to 1970; the opposite is true in the other two periods. The percentage change over all the five years is 19.65 for the CPI and 21.35 for the $(MCPI)_f$. The percentage change for the pure Laspeyre index is 16.3 for the CPI and 28.68 for the $(MCPI)_f$.

2. Variable Income Elasticity

Here the values obtained in Table 5-7 will be also used as the PI for food; then formula 5-3 is applied to get the reweighted value considering income elasticities not unitary. And finally, formula 5-2 is used to calculate the MCPI considering free housing, free medical care, food discount and income elasticity not unitary; this will be denoted by $(MCPI)_f^1$. The results obtained were the following:

FIG. 5-7

$(MCPI)_f$ WITH UNITARY ELASTICITY
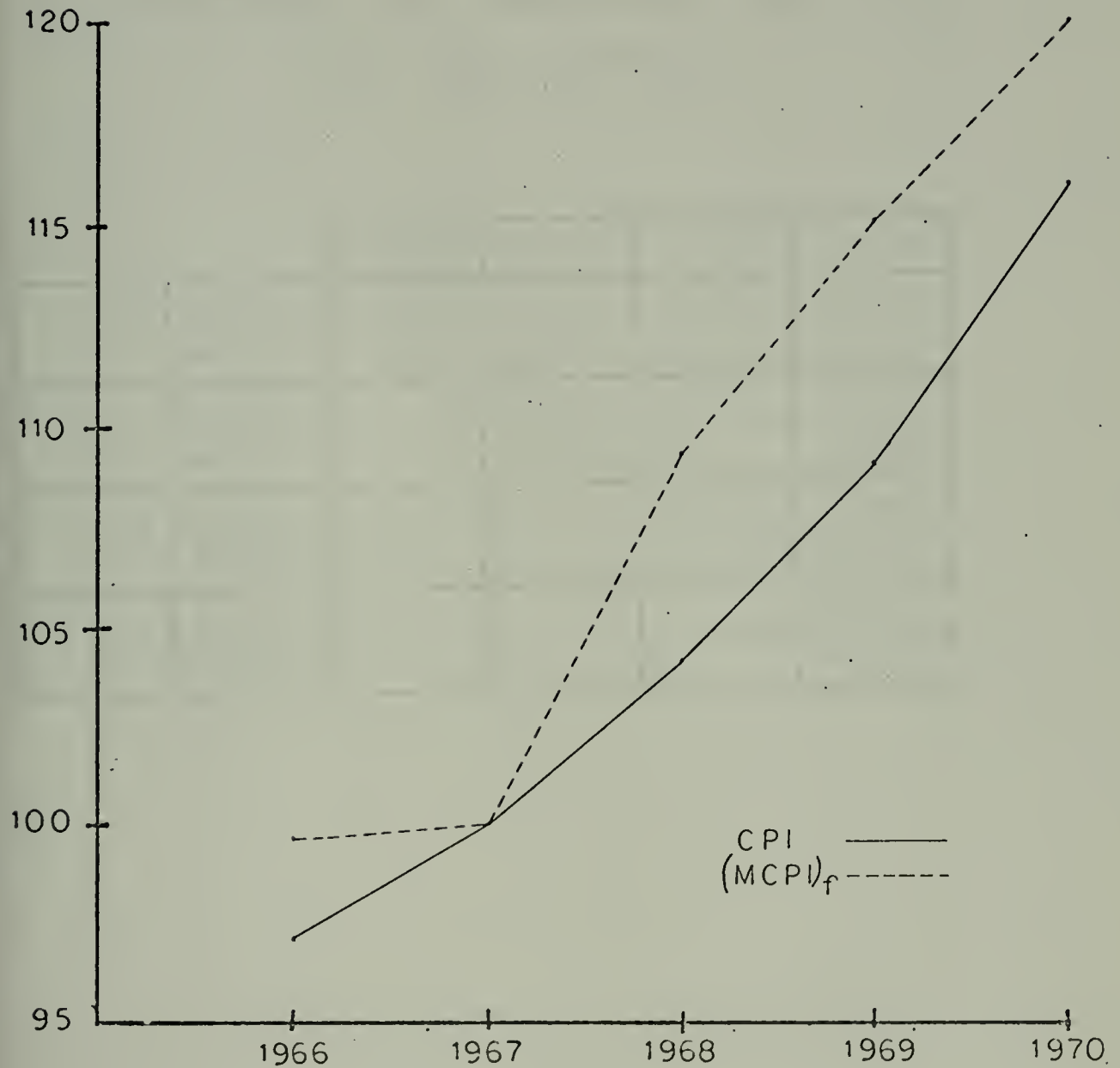
TABLE   5-7b

PERCENTAGE OF VARIATION FOR THE CPI AND $(MCPI)_f$

		1967	1968	1969	1970
1966	C P I	2.88	7.20	12.96	19.65
	MCPI	0.55	9.89	16.04	21.35
1967	C P I		4.2	9.8	16.3
	MCPI		9.29	15.4	20.68
1968	C P I			5.37	11.61
	MCPI			5.59	10.42
1969	C P I				5.92
	MCPI				4.58

TABLE 5-8

Year Index	1966	1967	1968	1969	1970
CPI	97.20	100.00	104.20	109.80	116.30
$(MCPI)_f^1$	98.87	100.00	107.95	113.63	118.84

In Table 5-8 it can be seen that the $(MCPI)_f^1$ is greater than the CPI in 1966, 1968, 1969, 1970. The percentage change year by year for the $(MCPI)_f^1$ is greater than the CPI only during the period from 1967 to 1968. The overall variation is 19.65 for the CPI and 20.20 for the $(MCPI)_f^1$. The percentage change for the pure Laspeyres index is 16.3 for the CPI and 18.84 for the $(MCPI)_f^1$.

FIG. 5-8

MCPI CONSIDERING FREE HOUSING,
FREE MEDICAL CARE FOOD DISCOUNT
AND INCOME ELASTICITY NOT UNI-
TARY
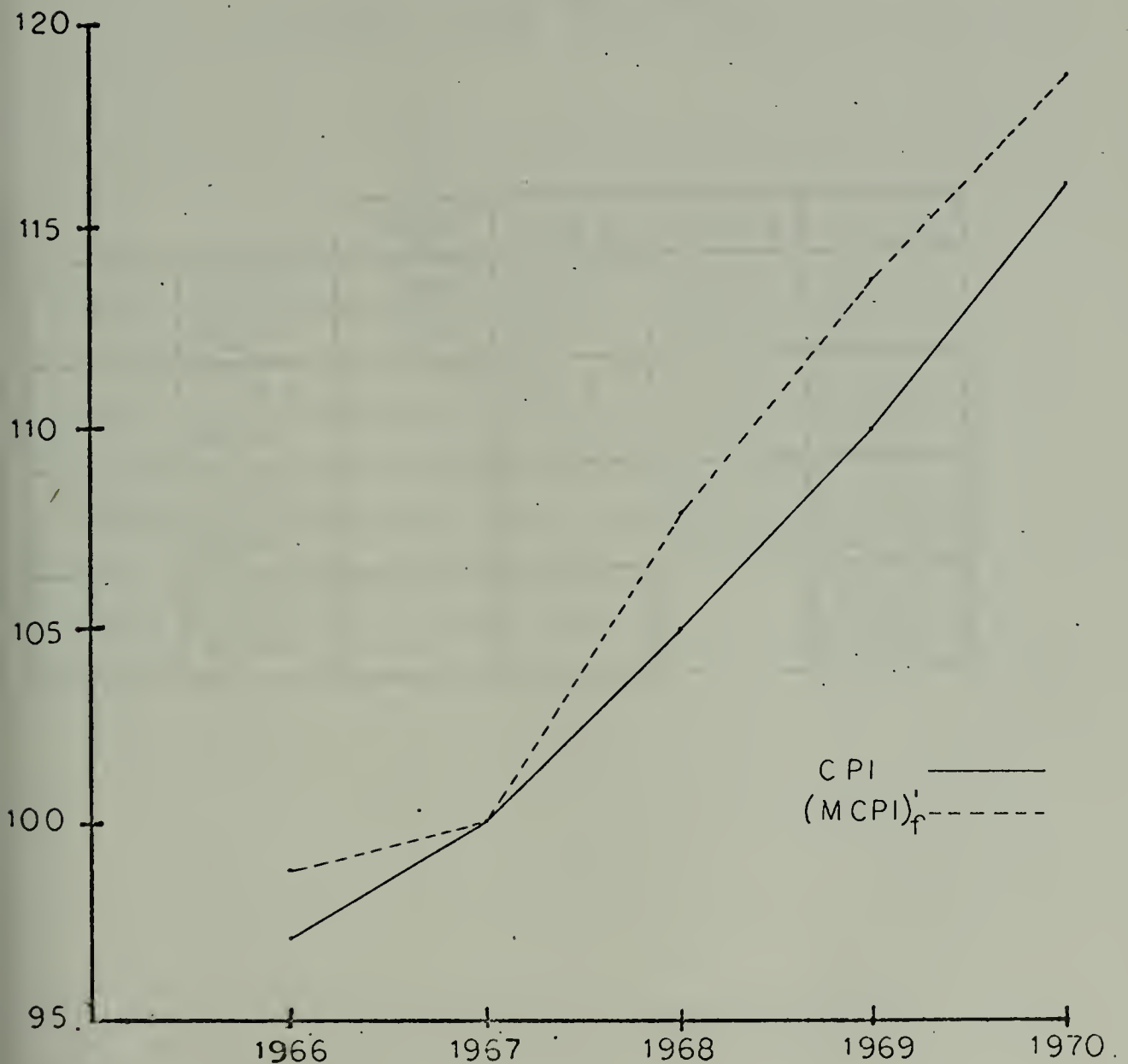
TABLE 5-8a

PERCENTAGE OF VARIATION FOR THE CPI AND (MCPI)$'_f$

		1967	1968	1969	1970
1966	C P I	2.88	7.20	12.96	19.65
	MCPI	1.14	9.18	14.93	20.20
1967	C P I		4.2	9.8	16.3
	MCPI		7.95	13.63	18.84
1968	C P I			5.37	11.61
	MCPI			5.26	10.09
1969	C P I				5.92
	MCPI				4.58

VI. CONCLUSIONS

The authors feel that the objectives which were posed at the beginning of this thesis has been accomplished within the limitations of the available data.

From the results obtained in the calculations of Chapter V we can draw the following conclusions:

1. The overall percentage of variation in the interval under consideration is less for the MCPI than for the CPI in all the cases. This implies that the change in the cost of living for military personnel was less than that for civilians during that period.

2. The percentage of variation year by year in most cases is smaller for the MCPI than for the CPI. Taking the $(MCPI)^1_{hm}$ as an example, it can be seen that with the exception of 1962 and 1964 the percentage change for the MCPI is smaller than the CPI. This implies that the cost of living for the military increased at a lower rate than for the civilians.

APPENDIX A

Considerations about the CPI when the individual saves
part of his income

In the calculation of the Consumer Price Index discussed in Chapter I, it was not considered that a consumer can save part of his income.

Superficially the existence of saving might seem to have no problem. If savings is considered as a good, then it has his own price and it might be thought that the theory study in Chapter I is adequate to deal with it.

But this theory is not convenient because the consumer's saving decision is assumed to be made in a one period context and due to this reason the reference level of utility is taken to be that of a single period for purpose of defining a CPI. It is better to consider this situation as the decision of an individual that makes an intertemporal allocation of his expenditures to maximize an interporal utility function instead of trying to maximize a utility function in a single period.

The basic model in this case is that a consumer wants to allocate his expenditures between two periods, zero and one. His utility level is U^0 for period zero and U^1 for period one. His intertemporal utility function is given by

$$M = f\left(U^0, U^1\right)$$

The utility function for each period is assumed to be the same and there are the "n" goods available for consumption.

The consumer expenditure in period zero can be defined:

$$\overline{E}^0 = I^0 - \overline{S}^0$$

Where:

$\overline{E}^0$ = Expenditure in period zero

I^0 = Income in period zero

$\overline{S}^0$ = Saving in period zero

And his expenditure in period one:

$$\bar{E}^1 = I^1 + \bar{S}^0(1 + r^0)$$

Where:

$\bar{E}^1$ = Expenditure in period one

I^1 = Income in period one

r^0 = Market rate of interest

Since the model of saving considered here is a two period model, the effect of a price change is to move the consumer from the level of intertemporal utility that he would have if the prices had remained constant to the level of intertemporal utility he actually has given period one prices. This intertemporal utility level should be taken as a reference utility level for measuring the CPI when the consumer saves. For an expanded treatment of this area, see "A True Price Index When the Consumer Saves", by Malcom Galatin.

Items Given Free Or With Some Discount To Military Personnel

Food at home

    Cereals and bakery products
    Meats, poultry, and fish
    Dairy products
    Fruits and vegetables
    Processed fruits and vegetables
    Other food at home
        Eggs
        Fats and oils
        Sugar and sweets
        Nonalcoholic beverages
        Prepared and partially prepared foods

Housing

    Shelter
        Rent
        Homeownership costs
            Maintenance and repairs
                Services
    Fuel and utilities
    Household furnishings and operation
        House furnishings
            Textiles
            Furniture and bedding
            Appliances
            Other house furnishings
            Housekeeping supplies

Apparel and upkeep
    Apparel commodities
        Apparel commodities less footwear
        Footwear

Transportation
    Private
        Gasoline, regular and premium
        Motor oil, premium
        Tires, new, tubless
        Auto repairs and maintenance
    Public
        Railroad fares, coach
        Airplane fares, chiefly coach
        Bus fares, intercity

Health and recreation
    Medical care
        Drugs and prescriptions

Over-the-counter items
                    Prescriptions
              Professional services
                    Physicians' fees
                    Dentists' fees
                    Other professional services
                    Hospital service charges
              Personal care
                    Toilet goods
                    Personal care services

         Reading and recreation
              Recreational goods
              Recreational services
                    Indoor movie admissions
              Other goods and services
                    Alcoholic beverages
                    Financial and miscellaneous personal expenses
                          Funeral services, adult
                          Legal service, short form will

SOURCE: Lt J. Jones, USN, Chief of the Military Personnel Office, Naval
         Postgraduate School, Monterey, California

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Cities and Population Weights Used in Constructing The CPI

City and size stratum	Population Weight
A. Standard metropolitan statistical areas of 1,400,000 or more in 1960:	
Baltimore, Md..	1.402
Boston, Mass...	1.930
Chicago-Northwestern Indiana................................	5.552
Cleveland, Ohio...	1.325
Detroit, Mich...	2.895
Los Angeles-Long Beach, Calif..............................	5.017
New York-Northeastern New Jersey...........................	12.577
Philadelphia, Pa...	2.703
Pittsburgh, Pa..	1.565
St. Louis, Mo...	1.428
San Francisco-Oakland, Calif...............................	2.372
Washington, D.C...	1.255
B. Standard metropolitan statistical areas of 250,00 to 1,399,999 in 1960:	
Atlanta, Ga...	2.934
Buffalo, N.Y..	2.347
Cincinnati, Ohio-Ky...	.740
Dallas, Tex...	2.934
Dayton, Ohio..	1.096
Denver, Colo..	1.838
Hartford, Conn..	2.348
Honolulu, Hawaii..	.354
Houston, Tex..	.999
Indianapolis, Ind...	1.095
Kansas City, Mo.-Kans.......................................	.710
Milwaukee, Wis..	.850
Minneapolis-St. Paul, Minn..................................	1.042
Nashville, Tenn...	2.933
San Diefo, Calif..	.672
Seattle, Wash...	1.837
Wichita, Kans...	1.096
C. Standard metropolitan statistical areas of 50,000 to 249,999 in 1960:	
Austin, Tex...	1.250
Bakersfield, Calif..	1.323
Baton Rouge, La...	1.250
Cedar Rapids, Iowa..	1.284
Champaign-Urbana, Ill.......................................	1.284

Durham, N.C................................	1.250
Green Bay, Wis.............................	1.284
Lancaster, Pa..............................	1.803
Orlando, Fla..............................	1.250
Portland, Maine...........................	1.803

D. Urban places of 2,500 to 49,999 in 1960:

Anchorage, Alaska.........................	.065
Crookston, Minn...........................	1.352
Devils Lake, N.Dak........................	1.352
Findlay, Ohio.............................	1.352
Florence, Ala.............................	1.227
Kingston, N.Y.............................	1.171
Klamath Falls, Oreg.......................	1.338
Logansport, Ind...........................	1.352
Mangum, Okla..............................	1.226
Martinsville, Va..........................	1.227
McAllen, Tex..............................	1.227
Millville, N.J............................	1.171
Niles, Mich...............................	1.351
Orem, Utah................................	1.339
Southbridge, Mass.........................	1.170
Union, S.C................................	1.227
Vicksburg, Miss...........................	1.226

Reference - B.L.S. Bulletin 1711, Revised 1972.

APPENDIX D

Items Prices In CPI By Expenditure Class

Expenditure class number	Classes	No. of items
	All items...	812
	Food...	267
	Food at home:	
	Cereals and bakery products:	
EC 1........	Cereals and grain products.....................	19
EC 2........	Bakery products................................	16
	Meats, poultry, and fish:	
EC 3........	Meats:	
	Beef and veal.............................	12
	Pork......................................	12
	Other meats...............................	14
EC 4........	Poultry..	4
EC 5........	Fish...	6
	Dairy products:	
EC 6........	Dairy products.................................	19
	Fruits and vegetables:	
EC 7........	Fresh fruits...................................	15
EC 8......../	Fresh vegetables...............................	20
EC 9........	Processed fruits and vegetables................	48
	Other food at home:	
EC 10......	Eggs...	1
EC 11......	Fats and oils..................................	8
EC 12......	Sugar and sweets...............................	12
EC 13......	Nonalcoholic beverages.........................	8
EC 14......	Prepared and partially prepared foods..........	50
EC 15......	Food away from home............................	3
	Housing..	212
	Shelter:	
EC 16......	Rent...	4
	Homeownership:	
EC 17......	Purchase and financing.........................	3
EC 18......	Taxes and insurance............................	2
	Maintenance and repairs:	
EC 19......	Commodities....................................	14
EC 20......	Services.......................................	30
EC 21......	Fuel and utilities.............................	5
	Household furnishings and operation:	
	Housefurnishings:	
EC 22......	Textile housefurnishings.......................	20
	Furniture and floor coverings:	
EC 23......	Furniture......................................	31
EC 24......	Floor coverings................................	7
EC 25......	Appliances.....................................	21
EC 26	Other housefurnishings.........................	32

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Expenditure class number	Classes	No. of items
	Household operation:	
EC 27......	Housekeeping supplies.........................	28
EC 28......	Housekeeping services........................	14
	Apparel and upkeep..............................	184
	Men's and boys' apparel:	
EC 29......	Men's apparel..................................	30
EC 30......	Boys' apparel.................................	23
	Women's and girls' apparel:	
EC 31......	Women's apparel................................	39
EC 32......	Girls' apparel................................	31
EC 33......	Footwear......................................	21
	Other apparel:	
EC 34......	Commodities...................................	26
EC 35......	Services......................................	14
	Transportation.................................	34
	Private:	
	Autos and related goods:	
EC 36......	Auto purchase.................................	2
EC 37......	Gasoline and motor oil........................	2
EC 38......	Auto parts, etc...............................	6
	Automobile services:	
EC 39......	Auto repairs and maintenance..................	13
EC 40......	Other automobile expenses.....................	5
EC 41......	Public..	6
	Health and recreation..........................	115
	Medical care:	
EC 42......	Drugs and prescriptions.......................	2
EC 43......	Professional services.........................	11
EC 44......	Hospital services and health insurance........	2
	Personal care:	
EC 45......	Toilet goods..................................	28
EC 46......	Services......................................	9
	Reading and recreation:	
	Recreation:	
EC 47......	Recreational goods............................	29
EC 48......	Recreational services.........................	13
EC 49......	Reading and education.........................	11
	Other goods and services:	
EC 50......	Tobacco products..............................	3
EC 51......	Alcoholic beverages...........................	3
EC 52......	Financial and miscellaneous personal expenses.	4

Reference - B.L.S. Bulletin 1711, Revised 1972.

APPENDIX E

Calculation Of The PI Considering Food Discount Only

Formula:
$$PI = \frac{\sum_i p_i^1 q_i^0}{\sum_i p_i^0 q_i^0} \times 100$$

In this formula the PI for a given year is known (for civilians) and we want to know how much this index is going to change if it's considered that the military people get most of their at a discount price.

The percentage of saving for the years 1966 to 1970 for the military people was:[24]

1970	1969	1968	1967	1966
30.5	29.6	31.0	39.4	36.5

To get the modified PI considering food discount only, the following relation will be used:

$$(PI)_m = \frac{D_i \sum_i (p_i^1 q_i^0)}{D_0 \sum_i (p_i^0 q_i^0)} \times 100 = (PI) \frac{D_i}{D_0}$$

Where

$D_i = 1 - $ (discount in year "i")

$D_0 = 1 - $ (discount in base year)

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[24] Source: Analysis of Miscellaneous Data from the Annual Survey of the Fort Ord Commissary Store.

APPENDIX F

Derivation Of The Formulas For The Reweighting System Based On Income
Elasticity

Formulas 5-1 and 5-3 will be derived, then one theorem and a Lemma
will be proved to give consistant to the derivations.

Let   I be the income level

X_i be the expenditure on commodity "i"

W_i be the quantity of commodity "i" purchased

p_i be the price of commodity "i"

Then

$$I = \sum_i X_i = \sum_i P_i Q_i \tag{1}$$

When all prices are constant, the relevant income elasticity can be
defined as:

$$\eta_{I_i} = \frac{\triangle X_i}{\triangle I} \cdot \frac{I}{X_i} \tag{2}$$

Define the weight of expenditure of commodity "i" as:

$$W_i = \frac{X_i}{I} \tag{3}$$

and

$$\sum W_i = 1 \tag{4}$$

From equations (2) and (3) we get:

$$\eta_{I_i} = \frac{\triangle X_i}{\triangle I} \cdot \frac{1}{W_i} = \frac{\frac{\triangle X_i}{I}}{\frac{\triangle I}{I}} \cdot \frac{1}{W_i} \tag{5}$$

Where $\frac{\triangle X_i}{I}$ is the change in the relative weight of i and is denoted
by $\triangle W_i$, and $\frac{\triangle I}{I}$ is the percentage change in income and is denoted by
"y", therefore

$$\eta_{I_i} = \frac{\triangle W_i}{y} \cdot \frac{1}{W_i}$$

or

$$\triangle W_i = \eta_{I_i} \cdot y \cdot W_i$$

The reweighted or redistributed weight $\left(W_i^1\right)$ of commodity "i" is then equal to:

$$W_i^1 = W_i + \triangle W_i$$

$$W_i' = W_i + \eta_{I_i} \cdot y \cdot W_i$$

$$W_i' = (1 + \eta_{I_i} y) \, W_i \tag{6}$$

This is the formula 5-3 used in Chapter V to calculate the reweighted value of commodity "i" when there is a change in income resulting from obtaining some commodities free.

The percentage change in income (y) or "income increase" can be represented by the redistribution of the weight of the commodities obtained free among the remaining weights. In symbols:

$$y = \frac{\sum\limits_{j}^{m} W_j}{\sum\limits_{i}^{n} W_i - \sum\limits_{j}^{m} W_j} \tag{7}$$

Where W_j = Weight of commodity "j" given free.

Now to show the condition under which equation 5-3 is a valid reweighting system we proceed as follows:

From equation (1)

$$I = \sum X_i$$

Taking derivatives with respect to I

$$1 = \sum \frac{dX_i}{dI}$$

Multiplying the right side of this expression by $\dfrac{I}{X_i} \cdot \dfrac{X_i}{I}$ we have

$$1 = \Sigma \ \frac{dX_i}{dI} \cdot \frac{I}{X_i} \cdot \frac{X_i}{I}$$

But from equations (2) and (3) we know that

$$\frac{\Delta X_i}{\Delta I} \cdot \frac{I}{X_i} = \eta_{I_i}$$

and

$$\frac{X_i}{I} = W_i$$

Then

$$1 = \overset{n}{\underset{i}{\Sigma}} \ \eta_{I_i} \ W_i \qquad\qquad (8)$$

Let η_{I_j} be the income elasticity for the items given free. j=1....m.

W_j be the weight for the items given free. j=1,2,....m.

η_{I_k} be the income elasticity for the remaining items that are not given free. k=1,2,....(n-m).

W_k be the weight for the remaining items that are not given free. k=1,2,....(n-m).

Then from equation (8)

$$1 = \overset{n-m}{\underset{k}{\Sigma}} \ \eta_{I_k} \ W_k + \overset{m}{\underset{j}{\Sigma}} \ \eta_{I_j} \ W_j$$

And from equation (4)

$$1 = \overset{n-m}{\underset{k}{\Sigma}} \ W_k + \overset{m}{\underset{j}{\Sigma}} \ W_j$$

Now we are ready to prove the theorem and lemma that we need for practical applications in Chapter V.

Theorem:

If the items given free are considered as an increase in income level, and if

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$$\sum_{j}^{m} W_j = \sum_{j}^{m} \eta_{I_j} W_j, \text{ for } j=1,2,\ldots m < n.$$

Then

$$\sum_{k}^{n-m} W_k = \sum_{k}^{n-m} (1 + \eta_{I_k} y) W_k, \text{ for } k=1,2,\ldots(n-m).$$

Proof:

By assumption $\displaystyle\sum_{j}^{m} W_j = \sum_{j}^{m} \eta_{I_j} W_j$, for j 1...m < n

But $\displaystyle\sum_{j}^{m} W_j = 1 - \sum_{k=1}^{n-m} W_k$, for k=1...(n-m)

Therefore $\displaystyle 1 - \sum_{k=1}^{n-m} W_k = \sum_{j}^{m} \eta_{I_j} W_j$

Multiplying and dividing by $\displaystyle\sum_{k=1}^{n-m} \eta_{I_k} W_k$ on the right hand side

$$1 - \sum_{k=1}^{n-m} W_k = \sum_{k}^{n-m} \eta_{I_k} W_k \frac{\sum_{j}^{m} \eta_{I_j} W_i}{\sum_{k=1}^{n-m} \eta_{I_k} W_k}$$

Or

$$1 = \sum_{k=1}^{n-m} W_k + \sum_{k=1}^{n-m} \eta_{I_k} \frac{\sum_{j}^{m} \eta_{I_j} W_j}{\sum_{i}^{n} \eta_{I_i} W_i - \sum_{j}^{m} \eta_{I_j} W_j} \cdot W_k$$

But from the assumption, equation (7) becomes

$$y = \frac{\sum_{j}^{m} \eta_{I_j} W_j}{\sum_{i}^{n} \eta_{I_i} W_i - \sum_{j}^{m} \eta_{I_j} W_j}$$

Then

$$1 = \sum_{k=1}^{n-m} W_k + \sum_{k=1}^{n-m} \eta_{I_k} \cdot y \cdot W_k$$

$$1 = \sum_{k=1}^{n-m} (1 + \eta_{I_k} \cdot y) W_k$$

and since

$$\sum_{k}^{n-m} W_k^1 = 1$$

We have

$$\sum_{k}^{n-m} W_k^1 = \sum_{k}^{n-m} (1 + \eta_{I_k} y) W_k \qquad\qquad \text{Q.E.D.}$$

Which implies

$$W_k^1 = (1 + \eta_{I_k} \cdot y) W_k$$

Lemma:

If all the income elasticities are unitary, then the reweight value (W_k) of commodity "k" is

$$W_k^1 = \frac{W_k}{\sum_{i}^{n} W_i - \sum_{j}^{m} W_j}$$

Proof:

By the theorem

$$W_k^1 = (1 + \eta_{I_k} y) W_k \qquad\qquad \eta_{I_k} \text{ not unitary}$$

Now by the assumption that $\eta_{I_k} = 1$ and from equation (7) we have

$$W_k^1 = \left(1 + \frac{\sum_{j}^{m} W_j}{\sum_{i}^{n} W_i - \sum_{j}^{m} W_j}\right) \cdot W_k$$

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$$W_k^1 = \left(\frac{\sum\limits_i^n W_i - \sum\limits_j^m W_j + \sum\limits_j^m W_j}{\sum\limits_i^n W_i - \sum\limits_j^m W_j} \right) \cdot W_k$$

$$W_k^1 = \left(\frac{W_k \sum\limits_i^n W_i}{\sum\limits_i^n W_i - \sum\limits_j^m W_j} \right.$$

but

$$\sum_i^n W_i = 1$$

therefore .

$$W_k^1 = \frac{W_k}{\sum\limits_i^n W_i - \sum\limits_j^m W_j} \qquad\qquad \text{Q.E.D.}$$

This is the formula 5-1 given in Chapter V to calculate the redistri-
buted weight for commodity "k" when the income elasticities are unitary
and some commodities are obtained free.

APPENDIX G

Tables for MCPI

TABLE I

MCPI CONSIDERING FREE HOUSING

ITEM	WEIGHT	RE-WEIGHT	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
1 ALL ITEMS	100.0	100.0	89.6	90.6	91.7	92.9	94.5	97.2	100.0	104.2	109.8	116.3
2 FOOD	22.4	33.53	89.1	89.9	91.2	92.4	94.4	99.1	100.0	103.6	108.9	114.9
3 HOUSING	33.2	—	90.9	91.7	92.7	93.8	94.9	97.2	100.0	104.2	110.8	118.9
4 APPAREL UPKEEP	10.6	15.87	90.4	90.9	91.9	92.7	93.7	96.1	100.0	105.4	111.5	116.1
5 TRANSPORTATION	13.9	20.81	90.6	92.5	93.0	94.3	95.9	97.2	100.0	103.2	107.2	112.7
6 MEDICAL CARE	5.7	8.53	81.4	83.5	85.6	87.3	89.5	93.4	100.0	106.1	113.4	120.6
7 PERSONAL CARE	2.8	4.19	90.6	92.2	93.4	94.5	95.2	97.1	100.0	104.2	109.3	113.2
8 READING RECREC.	5.9	8.83	89.3	91.3	92.8	95.0	95.9	97.5	100.0	104.7	108.7	113.4
9 OTHER	5.1	8.24	88.5	89.1	90.6	92.0	94.2	97.2	100.0	104.6	10.91	116.0
$(MCPI)_h$			88.99	90.20	91.39	92.37	94.34	97.36	100.0	103.72	109.36	114.84
PERCENT VAR. (annual)				1.36	1.32	1.07	2.13	3.20	2.71	3.72	5.44	5.01

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TABLE II

MCPI CONSIDERING FREE MEDICAL CARE (unitary-elasticities)

	ITEM	WEIGHT	RE-WEIGHT	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
1	ALL ITEMS	100.0	100.0	89.6	90.6	91.7	92.9	94.5	97.2	100.0	104.2	109.8	116.3
2	FOOD	22.4	23.75	89.1	89.9	91.2	92.4	94.4	99.1	100.0	103.6	108.9	114.9
3	HOUSING	33.2	35.21	90.9	91.7	92.7	93.8	94.9	97.2	100.0	104.2	110.8	118.9
4	APPAREL UPKEEP	10.6	11.24	90.4	90.9	91.9	92.7	93.7	96.1	100.0	105.4	111.5	116.1
5	TRANSPORTATION	13.9	14.74	90.6	92.5	93.0	94.3	95.9	97.2	100.0	103.2	107.2	112.7
6	MEDICAL CARE	5.7		81.4	83.5	85.6	87.3	89.5	93.4	100.0	106.1	113.4	120.6
7	PERSONAL CARE	2.8	2.97	90.6	92.2	93.4	94.5	95.2	97.1	100.0	104.2	109.3	113.2
8	READING RECREC.	5.9	6.26	89.3	91.3	92.8	95.0	95.9	97.5	100.0	104.7	108.7	113.4
9	OTHER	5.1	5.83	88.5	89.1	90.6	92.0	94.2	97.2	100.0	104.6	10.91	116.0
	(MCPI)m			90.12	91.13	92.20	93.41	94.82	97.54	100.0	104.1	109.62	116.04
	PERCENT VAR (annual)				1.12	1.17	1.31	1.51	2.87	2.52	4.1	5.3	5.86

TABLE III

AVERAGE INCOME ELASTICITY

GROUP OF ITEMS	INCOME ELASTIC.	WEIGHT	MODIFIED WEIGHT	AVERAGE ELASTIC.
FOOD	0.34	22.43	100.00	0.34
HOUSING	0.912	33.2	100.00	0.912
APPAREL AND UPKEEP				0.613
— Clothing including luggage				
— Other clothing	0.9012	2.18	20.5	
TRANSPORTATION				1.478
— Auto purchases	1.5	5.02	40.45	
— Auto services	1.348	3.62	29.17	
— Auto part	1.1729	0.72	5.8	
— Gasoline	1.6694	3.05	24.58	
PERSONAL CARE				3.1888
— Personal services	1.7136	1.23	44.73	
— Toilet goods	4.3826	1.52	55.27	
READING AND RECREATION				1.8648
— Recreation goods	2.12	2.78	63.76	
— Recreation services	1.4157	1.58	36.24	
OTHER GOODS AND SERVIC.				0.776
— Tobaco products	1.1517	1.89	38.26	
— Alcoholic beverages	0.5323	2.64	53.44	
— Funeral services	0.7623	0.28	5.67	
— Legal services	0.34	0.13	2.63	

TABLE IV

MCPI CONSIDERING FREE MEDICAL CARE AND ELASTICITIES NOT UNITARY

ITEM	WEIGHT	RE-WEIGHT	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
1 ALL ITEMS	100.0	100.0	89.6	90.6	91.7	92.9	94.5	97.2	100.0	104.2	109.8	116.3
2 FOOD	22.4	22.92	89.1	89.9	91.2	92.4	94.4	99.1	100.0	103.6	108.9	114.9
3 HOUSING	33.2	35.04	90.9	91.7	92.7	93.8	94.9	97.2	100.0	104.2	110.8	118.9
4 APPAREL UPKEEP	10.6	11.07	90.4	90.9	91.9	92.7	93.7	96.1	100.0	105.4	111.5	116.1
5 TRANSPORTATION	13.9	15.18	90.6	92.5	93.0	94.3	95.9	97.2	100.0	103.2	107.2	112.7
6 MEDICAL CARE	5.7	—	81.4	83.5	85.6	87.3	89.5	93.4	100.0	106.1	113.4	120.6
7 PERSONAL CARE	2.8	3.38	90.6	92.2	93.4	94.5	95.2	97.1	100.0	104.2	109.3	113.2
8 READING RECREC.	5.9	6.60	89.3	91.3	92.8	95.0	95.9	97.5	100.0	104.7	108.7	113.4
9 OTHER	5.1	5.81	88.5	89.1	90.6	92.0	94.2	97.2	100.0	104.6	109.1	116.0
$(MCPI)'_m$			90.13	91.16	92.22	93.43	94.84	97.53	100.0	104.10	109.61	116.01
PERCENT. VAR. (annual)				1.14	1.16	1.31	1.51	2.84	2.53	4.10	5.29	5.84

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MCPI CONSIDERING FREE HOUSING FREE MEDICAL CARE AND UNITARY INCOME ELASTICITIES

ITEM	WEIGHT	RE. WEIGHT	1961	1962	1963	1964	1965	1966	1967	19.68	1969	1970
1 ALL ITEMS	100.0	100.0	89.6	90.6	91.7	92.9	94.5	97.2	100.0	104.2	109.8	116.3
2 FOOD	22.4	36.66	89.1	89.9	91.2	92.4	94.4	99.1	100.0	103.6	108.9	114.9
3 HOUSING	33.2	——	90.9	91.7	92.7	93.8	94.9	97.2	100.0	104.2	110.8	118.9
4 APPAREL UPKEEP	10.6	17.35	90.4	90.9	91.9	92.7	93.7	96.1	100.0	105.4	111.5	116.1
5 TRANSPORTATION	13.9	22.75	90.6	92.5	93.0	94.3	95.9	97.2	100.0	103.2	107.2	112.7
6 MEDICAL CARE	5.7	——	81.4	83.5	85.6	87.3	89.5	93.4	100.0	106.1	113.4	120.6
7 PERSONAL CARE	2.8	4.58	90.6	92.2	93.4	94.5	95.2	97.1	100.0	104.2	109.3	113.2
8 READING RECREC.	5.9	9.66	89.3	91.3	92.8	95.0	95.9	97.5	100.0	104.7	108.7	113.4
9 OTHER	5.5	9.00	88.5	89.1	90.6	92.0	94.2	97.2	100.0	104.6	10.91	116.0
$(MCPI)_{hm}$			89.70	90.83	91.93	93.20	94.78	97.73	100.0	104.05	108.98	114.48
PERCENT VAR. (annual)				1.26	1.21	1.38	1.70	3.11	2.32	4.05	4.74	5.05

MCPI CONSIDERING FREE HOUSING FREE MEDICAL CARE AND
INCOME ELASTICITY NOT UNITARY

	ITEM	WEIGHT	RE-WEIGHT	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
1	ALL ITEMS	100.0	100.0	89.6	90.6	91.7	92.9	94.5	97.2	100.0	104.2	109.8	116.3
2	FOOD	22.4	27.3	89.1	89.9	91.2	92.4	94.4	99.1	100.0	103.6	108.9	114.9
3	HOUSING	33.2	—	90.9	91.7	92.7	93.8	94.9	97.2	100.0	104.2	110.8	118.9
4	APPAREL UPKEEP	10.6	15.0	90.4	90.9	91.9	92.7	93.7	96.1	100.0	105.4	111.5	116.1
5	TRANSPORTATION	13.9	27.3	90.6	92.5	93.0	94.3	95.9	97.2	100.0	103.2	107.2	112.7
6	MEDICAL CARE	5.7	—	81.4	83.5	85.6	87.3	89.5	93.4	100.0	106.1	113.4	120.6
7	PERSONAL CARE	2.8	8.7	90.6	92.2	93.4	94.5	95.2	97.1	100.0	104.2	109.3	113.2
8	READING RECREC.	5.9	13.2	89.3	91.3	92.8	95.0	95.9	97.5	100.0	104.7	108.7	113.4
9	OTHER	5.5	8.5	88.5	89.1	90.6	92.0	94.2	97.2	100.0	104.6	10.91	116.0
	$(MCPI)'_{hm}$			89.81	91.08	92.15	93.46	94.96	97.58	100.0	104.04	108.85	114.23
	PERCENT. VAR. (annual)				1.41	1.17	1.42	1.6	2.76	2.48	4.04	4.62	4.94

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TABLE VII

Population Weight For The 18 Largest SMSA

	Metropolitan Area	Weight	Reweight
1.	New York-N.Y.	12.58	25.69
2.	Chicago-Ill.	5.56	11.36
3.	Los Angeles-Ca.	5.02	10.25
4.	Philadelphia-Pa.-N.J.	2.70	5.52
5.	Detroit-Mich.	2.90	5.92
6.	San Francisco-Ca.	2.37	4.84
7.	Boston-Mass.	1.93	3.94
8.	Pittsburgh-Pa.	1.57	3.21
9.	St. Louis-Mo.-Ill.	1.43	2.92
10.	Washington, D.C.-Md.-Va.	1.26	2.57
11.	Cleveland-Ohio	1.33	2.72
12.	Baltimore-Md.	1.40	2.86
13.	Minneapolis-St. Paul-Minn.	1.04	2.12
14.	Buffalo-N.Y.	2.35	4.80
15.	Houston-Tex.	1.00	2.04
16.	Milwoukee-Wis.	0.85	1.74
17.	Dallas-Tex.	2.93	5.99
18.	Cincinnati-Ohio-Ky.	0.74	1.51
Total		48.96	100.00

TABLE VII

CPI FOR 18 LARGEST SMSA (1964-1970)

		WEIGHT CIVILIAN	1964	1965	1966	1967	1968	1969	1970
1	NEW YORK	25.69	92.8	94.3	97.5	100.0	104.3	110.8	119.0
2	CHICAGO	11.36	93.4	94.7	97.4	100.0	104.3	109.9	116.3
3	LOS ANGELES	10.25	93.7	95.7	97.5	100.0	163.9	108.8	114.3
4	PHILADELPHIA	5.52	93.2	94.7	97.3	100.0	104.8	110.4	117.8
5	DETROIT	5.92	90.5	92.6	96.7	100.0	104.3	110.6	117.4
6	SAN FRANCISCO	4.84	92.9	94.7	97.1	100.0	104.1	109.2	114.0
7	BOSTON	3.94	92.7	94.5	97.5	100.0	104.1	110.0	116.5
8	PITTSBURGH	3.21	94.3	95.8	98.3	100.0	104.7	110.4	116.4
9	ST. LOUIS	2.92	96.2	94.1	97.2	100.0	104.0	109.2	115.2
10	WASHINGTON DC	2.57	92.8	94.1	97.3	100.0	104.7	111.2	117.6
11	CLEVELAND	2.92	93.2	94.7	97.2	100.0	105.9	111.1	119.3
12	BALTIMORE	2.86	92.9	94.4	97.7	100.0	104.1	110.5	117.0
13	MINNEAPOLIS	2.12	93.2	94.5	96.8	100.0	104.6	109.9	117.5
14	BUFFULO	4.80	92.0	94.2	97.4	100.0	104.5	109.6	116.1
15	HOUSTON	2.04	93.7	94.8	97.5	100.0	104.3	111.0	116.8
16	MILWAKEE	1.74	93.9	95.8	98.0	100.0	103.5	109.5	115.8
17	DALLAS	5.99	92.6	93.8	97.1	100.0	104.5	111.3	117.8
18	CINCINATTI	1.51	93.7	94.4	97.2	100.0	104.8	109.8	115.7
	CPI		92.91	94.49	97.38	100.0	104.34	110.22	117.05

TABLE IX

POPULATION AND WEIGHT FOR THE CIVILIAN AND NAVY

	METROPOLITAN AREA	CIVILIAN WEIGHT	NAVY POPULATION	NAVY WEIGHT
1	NEW YORK	12.18	4,285	1.26
2	CHICAGO	5.56	446	6.13
3	LOS ANGELES	5.02	7,211	2.13
4	PHILADELPHIA	2.70	5,114	1.51
5	DETROIT	2.90	189	0.06
6	SAN FRANCIS.	2 37	11,859	3 50
7	BOSTON	1.93	1,278	0.38
8	PITTSBURGH	1.57	191	0.06
9	ST. LOUIS	1.43	182	0.05
10	WASHINGTON-DC	1.26	14,586	4 30
11	CLEVELAND	1.33	146	0.04
12	BALTIMORE	1.40	157	0.05
13	MINNEAPOLIS	1.04	727	0.21
14	BUFFALO	2.35	92	0.03
15	HOUSTON	1.00	151	0.04
16	MILWAKEE	0.85	68	0.02
17	DALLAS	2.93	884	0.26
18	CINCINNATI	8.74	72	0.02
19	OTHERS	51.04	29,1413	85.95
	TOTAL	100.00	339,050	100.00

TABLE X

(MCPI)g (56 Metropolitan areas and urban places of 2500 or more)

	METROPOLITAN AREA	WEIGHT CIVILIAN	WEIGHT NAVY	1964	1965	1966	1967	1968	1969	1970
1	NEW YORK	12.58	1.26	92.8	94.3	97.5	100.0	104.3	110.8	119.0
2	CHICAGO	5.56	0.13	93.4	94.7	97.4	100.0	104.3	109.9	116.3
3	LOS ANGELES	5.02	2.13	93.7	95.7	97.5	100.0	163.9	108.8	114.3
4	PHILADELPHIA	2.70	1.51	93.2	94.7	97.3	100.0	104.8	110.4	117.8
5	DETROIT	2.90	0.06	90.5	92.6	96.7	100.0	104.3	110.6	117.4
6	SAN FRANCISCO	2.37	3.50	92.9	94.7	97.1	100.0	104.1	109.2	114.0
7	BOSTON	1.93	0.38	92.7	94.5	97.5	100.0	104.1	110.0	116.5
8	PITTSBURGH	1.57	0.06	94.3	95.8	98.3	100.0	104.7	110.4	116.4
9	ST. LOUIS	1.43	0.05	96.2	94.1	97.2	100.0	104.0	109.2	115.2
10	WASHINGTON DC	1.26	4.30	92.8	94.1	97.3	100.0	104.7	111.2	117.6
11	CLEVELAND	1.33	0.04	93.2	94.7	97.2	100.0	105.9	111.1	119.3
12	BALTIMORE	1.40	0.05	92.9	94.4	97.7	100.0	104.1	110.5	117.0
13	MINNEAPOLIS	1.04	0.21	93.2	94.5	96.8	100.0	104.6	109.9	117.5
14	BUFFALO	2.35	0.03	92.0	94.2	97.4	100.0	104.5	109.6	116.1
15	HOUSTON	1.00	0.04	93.7	94.8	97.5	100.0	104.3	111.0	116.8
16	MILWAKEE	0.85	0.02	93.9	95.8	98.0	100.0	103.5	109.5	115.8
17	DALLAS	2.93	0.26	92.6	93.8	97.1	100.0	104.5	111.3	117.8
18	CINCINATTI	0.74	0.02	93.7	94.4	97.2	100.0	104.8	109.8	115.7
19	OTHERS	51.04	85.95	92.9	94.5	97.0	100.0	104.1	109.4	115.6
	MCPI			92.92	94.51	97.04	100.0	104.14	109.50	115.90
	PERCENT. VAR.				1.71	2.68	3.05	4.14	5.15	5.66

TABLE XI

MCPI CONSIDERING FREE HOUSING, FREE MEDICAL CARE, FOOD DISCOUNT AND UNITARY INCOME ELASTICITY

	WEIGHT	RE-WEIGHT	1966	1967	1968	1969	1970
ALL ITEMS	100.0	100.0	97.2	100.0	104.2	109.8	116.3
FOOD	22.4	36.66	103.8	100.0	117.9	126.4	131.8
HOUSING	33.2	——	97.2	100.0	104.2	110.8	118.9
APPAREL UPKEEP	10.6	17.35	96.1	100.0	105.4	111.5	116.1
TRANSPORTATION	13.9	22.75	97.2	100.0	103.2	107.2	112.7
MEDICAL CARE	5.7	——	93.4	100.0	106.1	113.4	120.6
PERSONAL CARE	2.8	4.58	97.1	100.0	104.2	109.3	113.2
READING RECREC	5.9	9.66	97.5	100.0	104.7	108.7	113.4
OTHER	5.5	9.00	97.2	100.0	104.6	109.1	116.0
(M C P·I)$_f$			99.45	100.0	109.29	115.4	120.68
PERCENT. VAR. (annual)				0.55	9.29	5.59	4.58

TABLE XII

CPI CONSIDERING FREE HOUSING, FREE MEDICAL CARE, FOOD DISCOUNT AND INCOME ELASTICITIES NOT UNITARY.

	WEIGHT	RE-WEIGHT	1966	1967	1968	1969	1970
ALL ITEMS	100.0	100.0	97.2	100.0	104.2	109.8	116.3
FOOD	22.4	27.3	103.8	100.0	117.9	126.4	131.8
HOUSING	33.2		97.2	100.0	104.2	110.8	118.9
APPAREL UPKEEP	10.63	15.0	96.1	100.0	105.4	111.5	116.1
TRANSPORTATION	13.9	27,3	97.2	100.0	103.2	107.2	112.7
MEDICAL CARE	57		93.4	100.0	106.1	113.4	120.6
PERSONAL CARE	28	87	97.1	100.0	104.2	109.3	113.2
READING RECREC	59	132	97.5	100.0	104.7	108.7	113.4
OTHER	55	85	97.2	100.0	104.6	109.1	116.0
$(MCPI)_f$			98.87	100.0	107.95	113.63	118.84
PERCENT VAR (annual)				1.14	7.95	5.26	4.58

Analysis of miscellaneous data from the annual survey of the Fort Ord Commissary Store.

1. Percentage of savings for the past five years:

1970	1969	1968	1967	1966
30.5%	29.6%	31.0%	39.4%	36.5%

The savings drop through the last three years is due to more competitive prices in the commercial stores.

This is the percentage by which the total cost of the average American family's annual grocery purchases at local commercial prices exceed the total cost at Commissary prices.

2. Percentage breakdown by departments:

	1970	1969	1968	1967
Grocery	32.0%	31.6%	33.4%	40.0%
Meat	27.4%	20.0%	24.0%	30.0%
Produce	53.9%	53.0%	39.1%	76.0%

Source: Annual Survey - Fort Ord Commissary Store.

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    This study presents an analysis of the differences in the cost of living between civilian and military families. An index analogous to the Consumer Price Index (CPI) is constructed for military personnel. In constructing this new index we discuss both the theoretical and empirical basis for the existing Consumer Price Indices. We obtain this modified CPI for the military (MCPI) using two approaches. First we construct a new index considering only the effect on the CPI of those commodities available either free

20. (cont'd)

or at reduced prices to military personnel. Second we construct a military counterpart of the CPI considering only the unique geographic distribution of the military personnel. Our results suggest that the MCPI has ri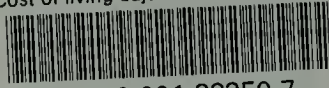sen less rapidly than the CPI during the period 1961-1970.